PAGE'S WEEKLY.—December 15, 1905. Thin Paper Copy for Circulation Abroad.

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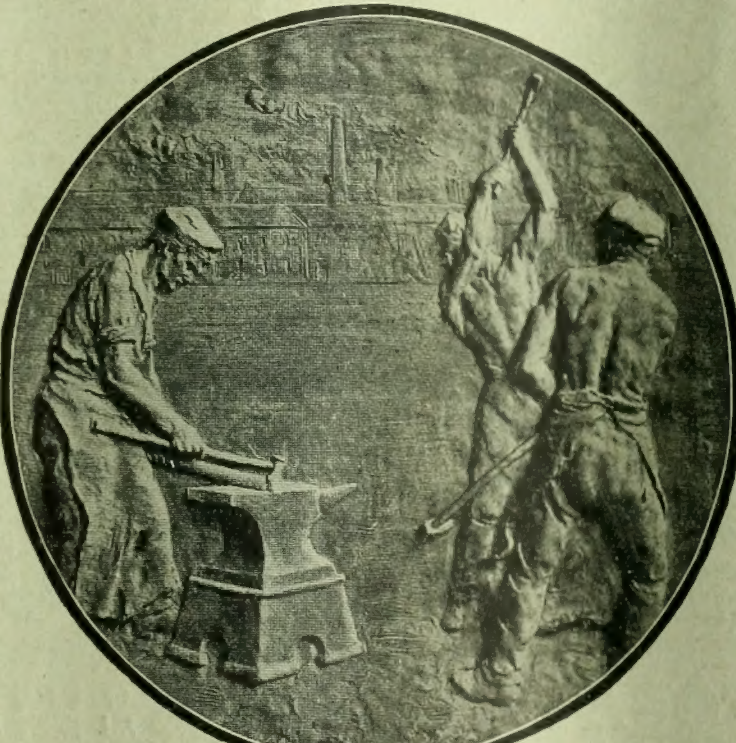
wrote for index Feb. 16/06

PAGE'S WEEKLY



ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

EDITORIAL & PUBLISHING OFFICES, CLUN HOUSE, SURREY STREET, STRAND, LONDON, W.C.

France, Paris : 22, Rue de la Banque.
Germany, Berlin : 13, Unter den Linden.
Russia, St. Petersburg : 14, Nevsky Prospect.
Italy, Rome : 307 Corso.
Austria, Vienna : Kärntnerstrasse, nr. 30.

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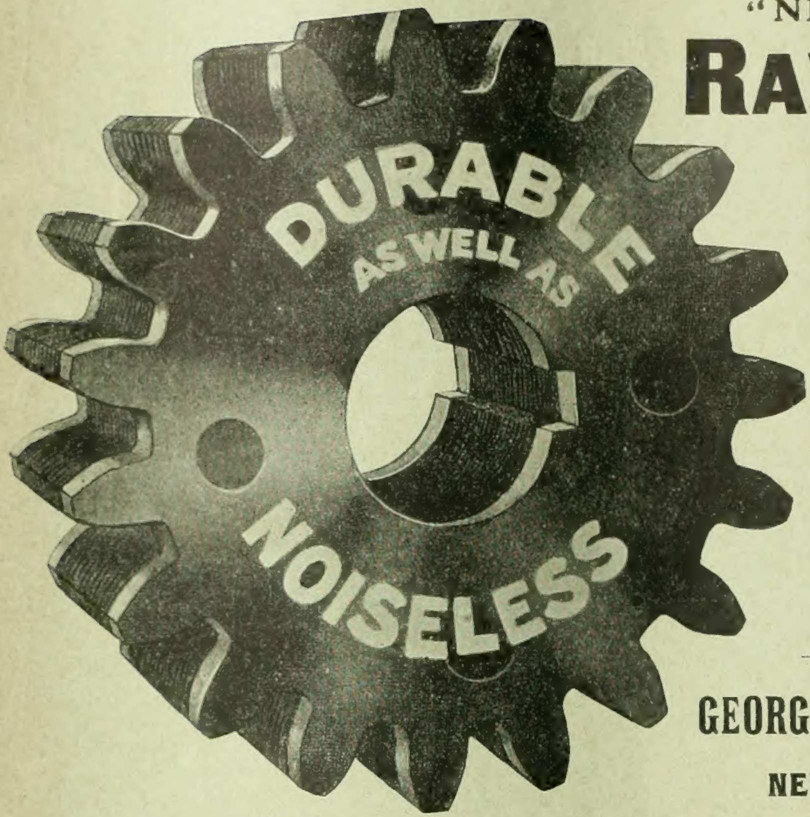

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RAW HIDE GEARS.

All Teeth Cut to Brown & Sharpe's Standards.

ALSO METAL GEARS.

Send for Descriptive Catalogue.

GEORGE ANGUS & CO., Ltd.,

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CYCLONE FANS FOR VENTILATION.

MATTHEWS & YATES, Ltd.,
Swinton, Manchester.

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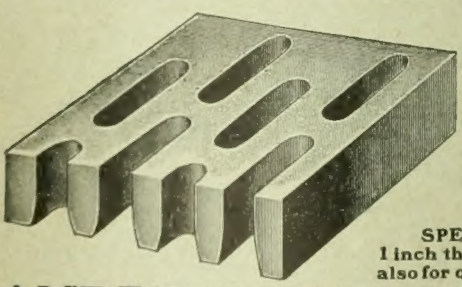

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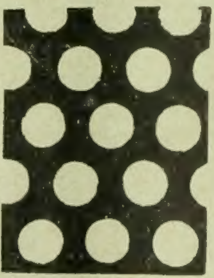
Filter Press Plates.
Rotary Sifting Plates, etc., etc.
Revolving Screens and Trommels, Black and Galvanized.
Embossed Plates for Stair Treads and Locomotive Steps.
Special Designs of Perforated Plates made exactly to drawings and up to one inch thick.

SPECIALITY.—Heavy Steel Plates up to 1 inch thick with narrow slots for crushing rolls; also for quarries, etc., in special hard quality steel.



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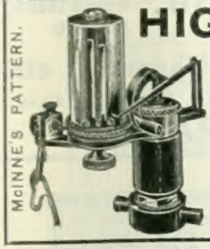
Sole Agents for FR. MEGUIN & CO., Ltd.

Telegraphic Address: "Browpost, London." Illustrated Catalogue Free. *Telephone*: 8168 BANK.

PAGE'S WEEKLY Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,
Consulting and Organising Engineer for Water Works and Industrial Undertakings,
19, OLD QUEEN ST., WESTMINSTER, S.W.
Telephone No.: 5754 Bank. Write for particulars.

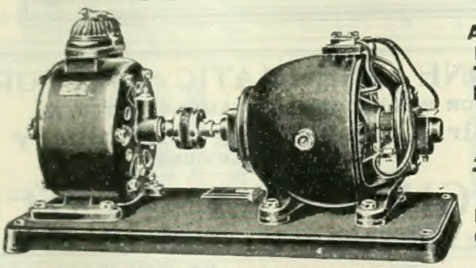


McINNE'S PATTERN.

HIGH SPEED INDICATORS.
Hannan & Buchanan,
75, Robertson Street, Glasgow.
ENGINE COUNTERS.
BOURDON GAUGES.
On Admiralty List.
Engineering Instrument Makers

CAST-IRON
COLUMNS,
STANCHIONS AND GIRDERS.
Head, Wrightson & Co., Thornaby, Stockton-on-Tees.

The Crypto Electrical Co.,

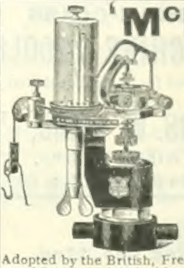


ALTERNATING TRANSFORMERS
3, TYERS GATEWAY, BERMONDSEY STREET, LONDON, S.E.

BRETT'S PATENT LIFTER CO., LTD.,
COVENTRY, ENG.
Speciality—
FORGING PLANT.
See our Advertisement appearing Dec. 22nd.
SEND FOR LATEST CATALOGUE.

Melville and Macalpine, Consulting Engineers and NAVAL ARCHITECTS,
615, WALNUT STREET, PHILADELPHIA, PA., U.S.A.
Rear-Admiral GEORGE W. MELVILLE, Ex-Engineer-in-Chief of the United States Navy, and JOHN H. MACALPINE, having a very extensive acquaintance in the best engineering circles in the United States, Britain, and the Continent of Europe, especially SOLICIT INTERNATIONAL BUSINESS.

A. MOUNT-HAES,
M.I.Mech.E., M.I.M.E.,
Consulting and Mining Engineer for Ore Dressing Plants of All Classes.
II, IRONMONGER LANE, LONDON, E.C
Tel. Address: "DRESSINGS, LONDON." Telephone No.: 272 Central.



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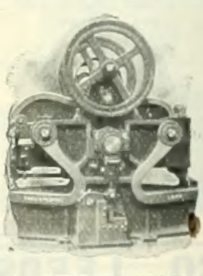
In Two types: External and Enclosed Pressure Springs.
Each made in several forms and sizes to suit all speeds and pressures.
Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.
DOBBIE, McINNES, LIMITED,
45, BOTHWELL ST., GLASGOW.
Adopted by the British, French, and Japanese Admiralties.

BABCOCK & WILCOX, Ltd.
PATENT WATER-TUBE BOILERS.
These Boilers are in use throughout the world to the extent of 4,700,000 h.p. generating steam for all purposes, and fired with all kinds of fuel.
See our Advertisement appearing Dec. 22nd, page 37.
HEAD OFFICES—Oriel House, Farringdon Street, LONDON, E.C.
WORKS—Renfrew, SCOTLAND.



PUNCHING & SHEARING Machines.
STEAM HAMMERS.
Shipbuilders' MACHINE TOOLS.
DAVIS & PRIMROSE,
Leith Ironworks, EDINBURGH.

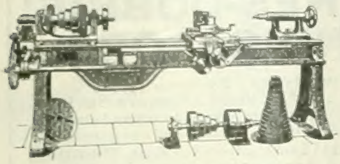
WAYGOOD LIFTS
APPLY FOR CATALOGUE.
FALMOUTH ROAD, LONDON, S.E.

STONE BREAKERS,
GRAVEL WASHERS, ETC.
SAMUEL PEGG & SONS, Engineers,
LEICESTER, England.
SEND FOR ILLUSTRATED CATALOGUE.

FOR THE BEST BOOKS BEARING ON THE INDUSTRIES DEALT WITH IN "PAGE'S WEEKLY," viz., ENGINEERING, ELECTRICAL, IRON AND STEEL, MINING AND SHIPBUILDING, ASK FOR CATALOGUE, CHARLES GRIFFIN & CO., LTD., 12, EXETER STREET, STRAND, LONDON, AND SEE SPECIAL ADVERTISEMENT ALTERNATE WEEKS.

PAGE'S WEEKLY Miscellaneous

I WANT A POSITION
as your Advertisement Manager.
SALARY REQUIRED 5/- PER ANNUM.
I will give my services FREE for the first month, if you will send a penny stamp to defray my travelling expenses.
The BRITISH ADVERTISER,
Queen Anne's Chambers, WESTMIMSTER, S.W.



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MACHINE TOOLS
In stock for immediate delivery
THOS. W. WARD, LD.
Albion Works,
SHEFFIELD.

TRANSPORTERS.
See our Advertisement appearing Dec. 22nd.
TEMPERLEY TRANSPORTER CO.,
72, Bishopsgate Street Within, LONDON, E.C.
Telephone: 365 London Wall. Telegrams: "Transumo."

WINN'S
RELIABLE
FIRE APPLIANCES
CHARLES WINN & Co
ST THOMAS WORKS
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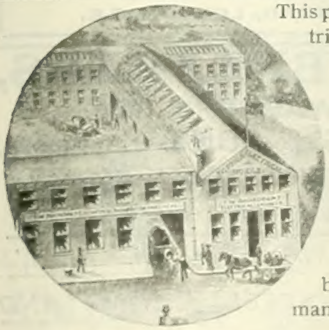
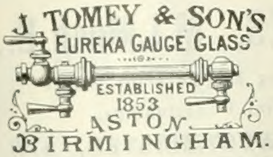
M. GLOVER & CO., LEEDS,
SAW MILL ENGINEERS,
"IDEAL" GUARDS, BENCHES, SHARPENERS,
FIREWOOD, and LIGHTER PLANTS,
Saving in Wages alone means
A CERTAIN LARGE INCOME.



This picture represents an Electrical Engineering Works in Yorkshire, which is specially laid out for the manufacture of Dynamos, Motors, Switches, and Switch boards. Everything is of the best; and prices are the lowest possible, consistent with best material and workmanship.

The Name and Address:
T. W. BROADBENT,
Victoria Electrical Works,
EAST PARADE, HUDDERSFIELD.



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EUREKA GAUGE GLASS
ESTABLISHED 1853
ASTON
BIRMINGHAM.

A NEW GAUGE GLASS.
Samples, Lists, and Testimonials on applicatio
"S.H.P."
Tested to 350 lb. Steam Pressure.
For High Pressure Boilers.

WALTER SCOTT, LTD., LEEDS STEEL WORKS, LEEDS, ENGLAND.
MANUFACTURERS OF . . .
Rolled Steel Joists, Channels, etc.
Mild Steel Blooms, Billets, Slabs, Tinbars, Rounds and Flats.
Speciality: **TRAMRAILS.**

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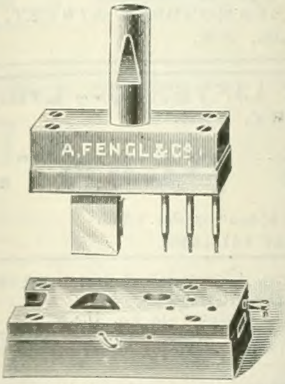
McTEAR & COMPANY, LTD
ROOF CONTRACTORS, FELT MANUFACTURERS, ETC
NEWTOWNARDS ROAD, BELFAST.
THE MAXIMUM OF AREA COVERED AT THE MINIMUM OF COST.
THE BEST ROOF FOR ALL PURPOSES
NEAT & STRONG.
FOR TANNERS, IRON FOUNDERS, ENGINEERS,
ROPEWALKS, COLLIERIES, SHIPBUILDERS, ELECTRICIANS.
SITES INSPECTED ESTIMATES FREE

SHONE PNEUMATIC EJECTORS
FOR RAISING SEWAGE, SLUDGE, WATER, &c.
Air Compressing Machinery
FOR ALL SERVICES.
HUGHES & LANCASTER
16, VICTORIA STREET, LONDON, S.W.



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If so, send your requirements, and
A. FENGL & CO.,
ALTRINCHAM,
will submit design and price.
Inventors' Models Worked Out and Manufactured.
STAMPINGS TO THE TRADE.
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Iron & Steel Bars, Plates, Sheets, Girders, Channels, Angles, Rails, Blooms, Billets, & Slabs.
Write for Section Lists and Prices.
Telegrams: "LEGATION, LEEDS."

PAGE'S WEEKLY. Miscellaneous

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Blue Planished and Glazed Steel Sheets for Lagging and Covering generally.

ZEITZ & Co., 21, Lime St., London, E.C.

MALLEABLE IRON & STEEL CASTINGS FOR ENGINEERS & TOOL MAKERS
TO MACHINE CLEAN & BRIGHT ALL OVER.
PARKER FOUNDRY CO. DERBY
ON ADMIRALTY LIST.

"TURPOLENE"

A perfect substitute for American Spirits of Turpentine for Painters, Printers, Varnish Makers, and for all other purposes where Turpentine is used.
Same odour, same flash point, same result in the working as in genuine Turps. We are the original and only makers of genuine Turpolene.
THE RELIANCE LUBRICATING OIL CO.,
19 & 20, Water Lane, Great Tower Street, London, E.C.
Branches at Glasgow, Bristol, Hull, Newcastle-on-Tyne, &c.

Refuse Destructors.

Write for particulars to:—

HEENAN & FROUDE, LIMITED,

4, Chapel Walks, MANCHESTER.

Works: MANCHESTER and WORCESTER.

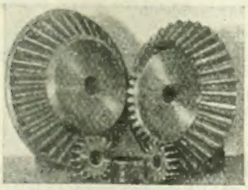
DESTRUCTORS and CLINKER MACHINERY.

Horsfall Destructor Co., Ltd., Armley, Leeds.
Telegrams: "DESTRUCTOR." Telephone: 2006.
Codes: A.B.C. (5th Edition) and Leiber's.

RIVETS, BOLTS, & SCREWS
Of all Descriptions and for all Purposes.
SEND FOR CATALOGUE.
T. D. ROBINSON & CO., Ltd.,
DERBY.

Steel Pipes WELDED & RIVETTED.

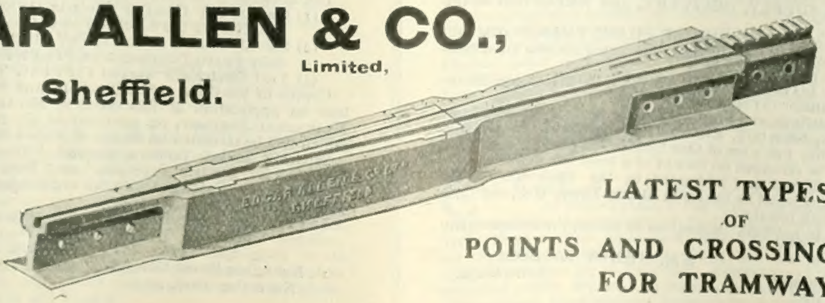
THOMAS PIGGOTT & CO., LTD., SPRING HILL, BIRMINGHAM. Send for Estimates.



Rawhide Gears
A SPECIALITY.
Also all kinds of Metal Gearing.
AD. AHLERS,
Whitley Bay, Newcastle-on-Tyne.

BERTRAMS, Ltd.,
Sciennes, EDINBURGH.
MACHINE TOOLS.
See Next Week.

EDGAR ALLEN & CO.,
Limited,
Sheffield.


EDGAR ALLEN & CO. LTD SHEFFIELD

LATEST TYPES
OF
POINTS AND CROSSINGS
FOR TRAMWAY WORK.

PAGE'S WEEKLY Contracts

CONTRACTS.

ELHAM UNION.—TO BOILERMAKERS, ETC.

The Guardians of this Union REQUIRE a LANCASHIRE BOILER.

Tenders are invited for the supply of same according to a Specification which can be obtained at my office as under, on payment of £1 1s. which will be returned on receipt of a *bona fide* Tender.

Tenders to be delivered at my office on or before Wednesday, December 27th.

The Guardians do not bind themselves to accept the lowest or any Tender.

R. LONERGAN,
Clerk.

11, Cheriton Place, Folkestone,
November 28th, 1905.

ELHAM UNION.—TO MAKERS OF SUPERHEATERS.

The Guardians of this Union REQUIRE one or more SUPERHEATERS.

Tenders are invited for the supply of same, according to a Specification which can be obtained at my office as under on payment of £1 1s. which will be returned on receipt of a *bona fide* Tender.

Tenders to be delivered at my office on or before Wednesday December 27th.

The Guardians do not bind themselves to accept the lowest or any Tender.

R. LONERGAN,
Clerk.

11, Cheriton Place, Folkestone,
November 28th, 1905.

COUNTY BOROUGH OF GRIMSBY.

ELECTRICITY DEPARTMENT.

The Grimsby Corporation are prepared to receive TENDERS for PLANT, BUILDINGS, and CABLES to the following Specifications :—

Specification No. 35.—Engine and Dynamo—500-kw. Continuous-Current Dynamo d.c to High-Speed Double-Acting Engine.
" No. 36.—Water-Tube Boiler and Underfeed Stokers.
" No. 37.—Extension of Switchboard.
" No. 38.—Condensing Plant—Surface Type.
" No. 39.—Buildings—Bills of Quantities for Extension of Engine-room, New Coal Bunkers, and New Store.
" No. 43.—Pipework.
" No. 44.—Coal-Conveying Plant—Two Scraper Conveyors and One Elevator.
" No. 45.—Supply of Cables (Lead-Covered Paper-Insulated).

A Pamphlet giving full particulars of the above will be sent to any firm on receipt of a stamped addressed foolscap envelope.

Copies of the respective Specifications, General Conditions, and Drawings (if any) can be obtained from the undersigned on payment of a deposit of One Guinea on each Specification, which will be returned upon receipt of a *bona fide* Tender. Extra copies of the Specifications may be purchased at 2s. 6d. each, except Specification No. 39—Bill of Quantities, which may be purchased at 5s. each; extra copies of Drawings 2s. 6d. each.

Tenders, on the prescribed form, in sealed envelopes, must be delivered to the undersigned not later than the first post, Friday, January 5th, 1906.

W. A. VIGNOLES,
Borough Electrical Engineer.

Corporation Electricity Works, Grimsby,
December 7th, 1905.

CITY OF MANCHESTER.—ELECTRICITY DEPARTMENT.

The Electricity Committee of the Manchester Corporation invite TENDERS for the SUPPLY, DELIVERY, and ERECTION of the following:—

(*a*) One Group of THREE SINGLE-PHASE TRANSFORMERS of 200 kw. each, constituting one complete 600 kw. Three-phase Transformer.

(*b*) HIGH and LOW-TENSION SWITCHBOARDS for Three-phase Transformer Sub-station.

Specifications, Drawings, and Forms of Tender may be obtained from Mr. F. E. HUGHES, Secretary, Electricity Department, Town Hall, Manchester, on payment of a fee of One Guinea for each Specification, which amount will be refunded on receipt of a *bona fide* Tender.

Tenders, duly endorsed and addressed to the Chairman of the Electricity Committee, must be delivered at the Town Hall, not later than Tuesday, the 19th instant.

The Corporation do not bind themselves to accept the lowest or any Tender.

WM. HENRY TALBOT,
Town Clerk.

Town Hall, Manchester,
December 5th, 1905.

CASTLEREA RURAL DISTRICT.

NOTICE.

BALLAGHADERREEN ELECTRIC LIGHTING.

The Rural District Council Castlerea, County of Roscommon, will, at their meeting to be held on Saturday, December 23rd, 1905, receive and consider TENDERS for the CONSTRUCTION of WORKS for Lighting the Town of Ballaghaderreen,

No. 1. Builders' Work in Constructing Houses, Weir Sluices, and Watercourse.
No. 2. Supplying and Erecting Hydraulic Turbine and Suction-Gas Engine Plant.
No. 3. Supplying and Erecting Electrical Work.

Specifications and Particulars may be had from CHRISTOPHER MULVANY, Esq., M.I.C.E., Engineer's Office, Athlone, on payment of One Pound as a deposit, returnable after receipt of *bona fide* Tender.

Sealed Tenders, giving the names of two solvent sureties willing to enter into a joint and several bond for the due performance of the Contract, and endorsed with the name of the Work, are to be addressed to the Presiding Chairman, District Council Office, Castlerea, and must reach the District Council Office not later than 12 o'clock noon on above-named day.

The Council do not bind themselves to accept the lowest or any Tender, or to defray any expense incurred in making the Tender.

By order,
P. A. FLANAGAN,
Clerk of the Council.

District Council Office, Castlerea,
November 18th, 1905.

CITY OF LAUNCESTON, TASMANIA.

ELECTRIC LIGHT DEPARTMENT.

TENDERS FOR SUPPLY OF METERS.

The MAYOR and ALDERMEN of the City of Launceston, Tasmania, are prepared to receive TENDERS for the SUPPLY of 500 or more ELECTRIC METERS and for MAXIMUM DEMAND INDICATORS.

Specifications and Conditions of Contract in duplicate may be obtained on application to Mr. WILLIAM CORIN, City Electrical Engineer, Launceston, Tasmania, or to Messrs. JOHN TERRY AND CO., 7, Great Winchester Street, London, E.C., England, on payment of Two Guineas, which sum will be refunded on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed "Tenders for Supply of Electric Meters," must be addressed to the undersigned and lodged in his office not later than 12 o'clock noon of Monday, the 15th day of January, 1906.

C. W. ROCHER,
Town Clerk.

Town Hall, Launceston, Tasmania,
September 25th, 1905.

OXIDE SHED.

THE GAS COMMITTEE OF THE COVENTRY CORPORATION

invite TENDERS for the SUPPLY and ERECTION at their Foleshill Works of OXIDE SHED, 322 ft. long by 62 ft. 6 in. wide, formed of Cast Iron Columns and Steel Roof, covered with Corrugated Sheets.

Specification and Form of Tender, with Bill of Quantities, may be obtained on application to the undersigned, and prints of the drawings will be supplied on payment of One Guinea which will not be returned.

The Committee do not bind themselves to accept the lowest or any Tender.

Tenders must be delivered not later than the first post on Monday, December 18th, addressed to the Chairman of the Gas Committee, Gas Works, Coventry, and endorsed "Tender for Oxide Shed."

FLETCHER W. STEVENSON,
Engineer and General Manager.

Gas Works, Coventry.
November 29th, 1905.

CLYDE NAVIGATION.—TO CRANE, CAPSTAN, and TURNTABLE MAKERS, and ELECTRICAL ENGINEERS.

EQUIPMENT OF CLYDEBANK DOCK.

The Trustees of the Clyde Navigation invite TENDERS for :—

(1) One 20-ton Hand or Electric OVERHEAD TRAVELLING CRANE for the Electric Power Generating Station.
(2) Six Electrically driven QUAY CAPSTANS, and Two Electrically driven Double-geared PIERHEAD CAPSTANS, and
(3) Two Electrically worked TIPPING TURNTABLES.

Copies of the General Specifications and Forms of Tender may be had on application at this office to Mr. GEORGE H. BAXTER, the Mechanical Engineer, on payment of £1 1s. for each Specification, which will be refunded on receipt of a *bona fide* Tender.

Separate sealed Tenders, marked "Tender for 20-Ton Crane," "Tender for Electric Capstans," or "Tender for Electric Tipping Turntables," to be lodged with the undersigned not later than noon on Monday, December 18th.

The Trustees may not accept the lowest or any Tender.

T. R. MACKENZIE,
General Manager and Secretary.

16, Robertson Street, Glasgow,
November 22nd, 1905.

PAGE'S WEEKLY Contracts and Appointments Open

BOROUGH OF PLYMOUTH.

ELECTRICITY DEPARTMENT.

The Plymouth Corporation is prepared to receive TENDERS for the SUPPLY and ERECTION of COAL DISCHARGING AND CONVEYING APPARATUS.

Copies of the Conditions, Specification, and Forms of Tender, may be obtained from the undersigned on the deposit of One Guinea, which will be returned on receipt of a *bona fide* Tender upon the prescribed form, and within the stated time.

Should the Contractor withdraw his Tender the amount of his deposit will be forfeited.

Sealed Tenders, duly endorsed, must be delivered to the undersigned not later than Saturday, December 23rd, 1905.

The Corporation does not bind itself to accept the lowest or any Tender.

E. G. OKELL,
Borough Electrical Engineer.

Electricity Works,
Prince Rock, Plymouth,
December 4th, 1905.

NEWPORT (MON.) GAS COMPANY.

The Directors of the Newport (Mon.) Gas Company are prepared to receive TENDERS for the WORKS hereinafter described to be carried out at their Crindau Gasworks, Newport (Mon.), viz.:—

Contract No. 1.—Extension of existing Retort House, Raising Walls of Building and Roof, Construction of Siding, and Alteration of existing Sidings.

Contract No. 2.—Construction of Regenerative Retort Settings (Horizontal) of 216 Mouthpieces, with all Mains, Fittings, Stage Floor, Coal-handling Plant, comprising coal breaker, elevator, conveyor, hoppers, wagon-tipping travelling crane, capstans, and motors.

Contract No. 3.—Coke-handling Plant, comprising Telpher system, coke trams, and narrow-gauge railway.

Contract No. 4.—Gas Engines and Plant for Generating and Distributing Power on Works.

Contract No. 5.—A Set of Six Purifiers, with Valves, Connections and Shed.

Drawings and Specifications may be seen on application to Mr. THOMAS CANNING, A.M.Inst.C.E., the Engineer, Gasworks, Mill Street, Newport (Mon.), on and after the 11th day of December, 1905, and copies of the Specification, Schedule, and Form of Tender can be obtained on receipt by the undersigned of Five Guineas, which will be returned when a *bona fide* Tender is received.

Tenders, addressed to the Chairman of the Company, to be lodged with the undersigned on or before Wednesday, January 3rd, 1906, sealed and endorsed as directed under the Specifications for each portion of the works.

The Directors do not bind themselves to accept the lowest or any Tender.

T. H. HAZELL,
Secretary.

Gas Offices,
Mill Street, Newport (Mon.),
November 30th, 1905.

GREAT CROSBY URBAN DISTRICT COUNCIL.

TO SEWERAGE CONTRACTORS.

The Great Crosby Urban District Council invite TENDERS for the LABOUR AND PART OF THE MATERIALS REQUIRED FOR THE CONSTRUCTION OF the following SEWERS:—

About 120 lin. yards 36 in. Concrete Pipes,
About 792 lin. yards 4 ft. by 2 ft. 8 in. Brick Sewer,
About 1,548 lin. yards 3 ft. 9 in. by 2 ft. 6 in. Brick Sewer,
About 1,065 lin. yards 18 in. Concrete Pipes,

together with all manholes, etc.

Plans and Specification may be examined daily, during office hours, and copy of quantities obtained on application to Mr. WATKIN HALL, A.M.Inst.C.E., Surveyor to the Council, on payment of £3 3s., which will be returned on receipt of a *bond fide* Tender.

The Council do not bind themselves to accept the lowest or any Tender.

Sealed Tenders endorsed "Outfall Sewers," to be addressed to the "Chairman of the Council," and delivered at the Council Offices, by noon on Wednesday, December 20th.

Dated this 29th of November, 1905.

Council Offices, Coronation Road,
Great Crosby, Lancs.

JOSIAH DEAN,
Clerk and Solicitor.

NORTH-EASTERN RAILWAY.— TO CONTRACTORS.

—The Directors are prepared to receive TENDERS for the WORKS required in connection with the RECONSTRUCTION of No. 4 GRAVING DOCK, West Hartlepool. Plans may be seen, and copies of the Specification and Quantities obtained, on personal application only to Mr. T. M. NEWELL, Engineer, Dock Office, Hull, on and after December 13th, 1905. Sealed Tenders, marked "Tender for No. 4 Graving Dock, West Hartlepool," to be delivered at the Secretary's Office, York, not later than 12 noon on Wednesday, January 10th, 1906. The Company do not bind themselves to accept the lowest or any Tender.

R. F. DUNNELL,
Secretary

York, December 4th, 1905.

APPOINTMENTS OPEN.

BINGHAM RURAL DISTRICT COUNCIL.

APPOINTMENT OF HIGHWAY SURVEYOR.

The above Council invite applications for the appointment of Highway Surveyor for the Rural District of Bingham.

There are about 190 miles of district roads and 40 parishes in the district.

The salary will be £150 per annum. The person appointed must have had previous experience or training in the duties appertaining to the office, and must be thoroughly qualified to perform such duties. He must not be under 25 years nor over thirty-five years of age, and will be required to devote his whole time to the duties, and to reside within the district.

The person appointed will also be required to give approved security to the amount of £200 for the due performance of his duties.

Applications (marked "Highway Surveyor"), in the handwriting of the candidate, stating age, and previous experience, and when the candidate could commence his duties, and accompanied by copies of not more than three recent testimonials, must be delivered at my office not later than Wednesday, December 20th next

Canvassing members of the Council, either directly or indirectly, will be deemed a disqualification. (By order)

R. H. BEAUMONT,
Clerk.

Bingham, Notts,
November 30th, 1905.

HIGH-CLASS APPOINTMENT.—

Nobel's Explosives Company, Ltd., require for their Military Cartridge Case and Ammunition Works and Rolling Mills at Birmingham, the services of a GENERAL MANAGER. Salary, minimum £1,000, but to a first-class man higher remuneration would be given.

Experience necessary to take full control (manufacturing administrative), with scientific and practical knowledge of mechanical engineering, familiarity with the organisation and administration of large works, and undoubted commercial ability are essential.

Some acquaintance with metallurgy and the chemistry of metals desirable.

Applicants must state age, remuneration required, and give full particulars of their education, scientific and engineering training, business experience, and how soon they can be at liberty.

Applications will be regarded as strictly confidential.

Address, Chairman, Birmingham Metal and Munitions Co., Ltd., Adderley Park Rolling Mills, Birmingham.

BURMA RAILWAYS.—ASSISTANT CARRIAGE AND WAGON SUPERINTENDENT.

The Directors of the Burma Railways Company are prepared to receive APPLICATIONS (by letter only) from duly qualified candidates for APPOINTMENT as

ASSISTANT CARRIAGE and WAGON SUPERINTENDENT to take charge of the carriage and wagon shops at Insein under the Locomotive and Carriage Superintendent.

Candidates should not be less than (about) 32 years or more than 36 years of age.

Must have had a good general education and also a sound engineering training, and several years' experience in the carriage and wagon shops of a British railway, or of a first-class railway carriage and wagon builders.

Preference will be given to candidates who have, in addition to the above, drawing office experience, and a practical knowledge of train lighting by electricity.

The officer appointed will remain in the carriage and wagon department all his service, and may eventually take independent charge as carriage and wagon superintendent,

Salary, Rs. 700 first year, Rs. 750 second year, and Rs. 800 third year, per calendar month, plus exchange compensation allowance.

If service is continued on termination of agreement the salary may be still further increased.

Terms.—A first-class free passage out and home and a three years' agreement in the first instance.

The selected candidate will be required to pass a medical examination by the Company's consulting physician before appointment.

Letter of application (giving candidate's age, and stating whethe married or single) should be accompanied by a brief record in chronological order of candidate's career—with dates—and copies (no originals) of testimonials, marked outside "Asst. Carr. and Wagon Supt." should be addressed to the undersigned not later than December 21st, 1905.

Company's Offices, 76, Gresham House,
Old Broad Street, E.C.

A. G. BEGBIE,
Managing Director.

CITY OF AUCKLAND, NEW ZEALAND.

APPOINTMENT OF CITY ENGINEER.

Applications, accompanied by Testimonials, will be received in the Town Clerk's Office, Auckland, New Zealand, until 4 o'clock p.m. on Thursday, February 8th, 1906, for the appointment of City Engineer to the City of Auckland. Conditions of appointment may be seen, and copies obtained, at the office of the High Commissioner for New Zealand, Westminster Chambers, 13, Victoria Street, London, S.W.

HENRY W. WILSON,
Town Clerk.

September 1st, 1905.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 22 and 24.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Advertisers' Service Bureau.
British Advertiser Service Bureau, Queen Anne's Chambers Westminster, S.W.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Band Sawing Machines.
Noble & Lund, Ltd., Felling-on-Tyne.

Bearings (Roller).
Hyatt Roller Bearing Co., 47, Victoria Street, London, S.W.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Cort, Arthur, & Co., Camberwell, London, S.E.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Boiler and Crank Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.
Thompson, John, Wolverhampton.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Stirling Boiler Co., Ltd., Motherwell, N.B.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.

Cables.
Callender's Cable and Construction Co., Ltd.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Castings.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Spottiswoode Advertising Agency, Clun House, Surrey Street, Strand, W.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
Ashmore, Benson, Pease & Co., Ltd., Stockton-on-Tees.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Coke Oven Expert.
Mallmann, P. J., 110-118, Victoria Street, S.W.

Condensing Plant.
Benn, Sykes, Haslingden, near Manchester.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 19, Old Queen Street, Westminster, S.W
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.
Mount-Haes, A., M.I.Mech.E., M.I.M.E., 11, Ironmonger Lane, London, E.C.

Continental Railway Arrangements.
Northern Railway of France.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Copper and Brass.
W. Hepton & Son, Hunslet Lane, Leeds.

Coverings (Boiler).
Magnesia Covering Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Drilling Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Niles-Bement-Pond Co., 23-25, Victoria Street London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne
Swift, George, Clarence Ironworks, Halifax.

Economisers.
E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 16, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
British Westinghouse Electric and Manufacturing Co., Ltd., Norfolk Street, Strand, London, W.C.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Ebonestos Manufacturing Co., 22, Rosoman Street, London, E.C.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., Silvertown, London, E.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
New Gutta Percha Co., Ltd., Dashwood House, New Broad Street E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Scott, E., & Mountain, Ltd., Newcastle-on-Tyne.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co. (*see* Ebonestos Manufacturing Co.), 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Gas).
Campbell Gas Engine Co., Ltd., Halifax.
Cundall, Son & Co., Ltd., Airedale Iron Works, Shipley.

Engines (Electric Lighting).
McLaren, J. and H., Midland Engine Works, Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A.
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.
McLaren, J. & H., Midland Engine Works, Leeds.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus, London E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Mirrlees Watson Co., Ltd., Glasgow.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E

PAGE'S WEEKLY Aerial Ropeways

BULLIVANTS

WIRE ROPES WIRE ROPES WIRE ROPES WIRE ROPES WIRE ROPES WIRE ROPES WIRE ROPES WIRE ROPES WIRE ROPES

STEEL WIRE ROPES

AND APPLIANCES.

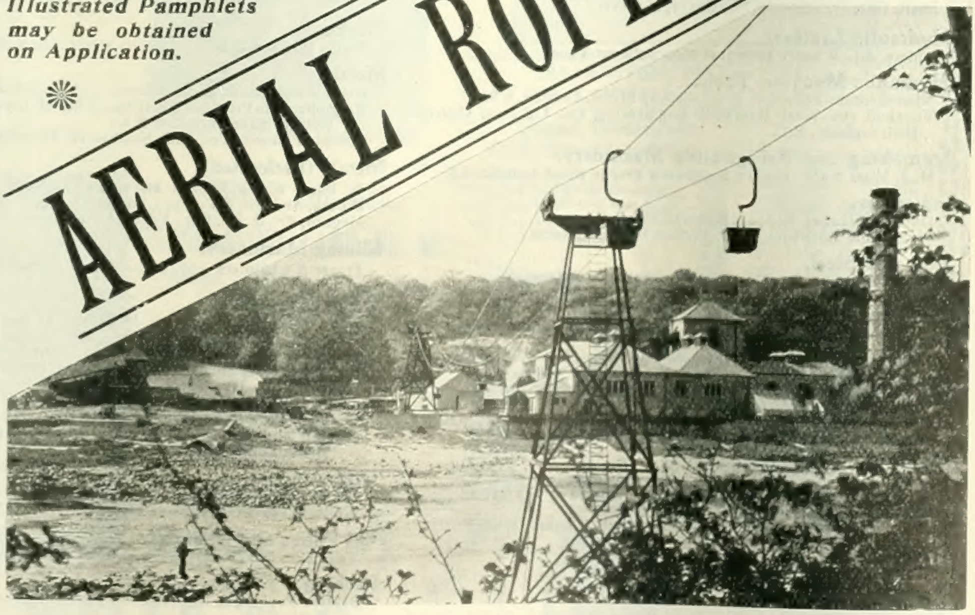
FLEXIBLE STEEL WIRE ROPES
FOR
Cranes, Lifts, Hoists, Etc.

ABSOLUTELY RELIABLE.
ONLY ONE UNIFORM QUALITY.

Blocks, Pulleys,
Crab Winches, Tackle, Etc.
MINING & HAULING
PLANT.

Illustrated Pamphlets may be obtained on Application.

AERIAL ROPEWAYS
ON ALL SYSTEMS



ROPEWAY AT WYLAM-ON-TYNE.

Ropeways Constructed to Convey from 50 to 2,000 Tons per day to Transport all Descriptions of Materals.

Regd. Offices :
72, MARK LANE. Telephone No.: 2110 Avenue.

BULLIVANT & CO., Ltd.,
LONDON, ENGLAND.

Works :
MILLWALL, E.

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.
Tomey, J., & Sons, Aston, Birmingham.

Gauges (Pressure, Vacuum, and Hydraulic).
Dobbie, McInnes, Ltd., 45, Bothwell Street, Glasgow.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Angus, G. & Co., Ltd., Newcastle-on-Tyne.
Asquith, William, Ltd., Well Road Works, Halifax.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hack Saws.
Baynes, Charles, Knuzden Brook, Blackburn.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Swift, George, Clarence Ironworks, Halifax.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Hydraulic Machine Tools.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Vauxhall and West Hydraulic Engineering Co. Ltd., 23, College Hill, London, E.C.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 45, Bothwell Street, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Allen, Edgar, & Co. Ltd., Imperial Steel Works, Sheffield.
Askham Bros. & Wilson, Ltd., Sheffield.
Buckley, Saml., St. Paul's Square, Birmingham.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds. England.
Flockton, Tompkin & Co., Ltd., Newhall Steel Works, Sheffield.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London,.E.C.

Lathes.
Asquith, William, Ltd., Well Road Works, Halifax.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Parsonage Works. Keighley.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Clarence Ironworks, Halifax.

Lathe Carriers
Williams, J. H., & Co., Brooklyn New York, U.S.A.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
Asquith, William, Ltd., Well Road Works, Halifax.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Beanland, Perkin, & Co., School Close Works, Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Consolidated Pneumatic Tool Co., Ltd., Palace Chambers, 9, Bridge Street, Westminster, S.W.
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Dean, Smith & Grace, Ltd., Keighley.
Dempster, Moore & Co., Ltd., 49, Robertson Street, Glasgow.
Fengl, A., & Co., Grafton Street, Altrincham.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund. Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Resides, 12, Aire Street, Brighouse, Yorks.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
Swift, George, Clarence Ironworks, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill Birmingham.
Vauxhall and West Hydraulic Engineering Co., Ltd., 23, College Hill, London, E.C.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co. (see Vauxhall and West Hydraulic Engineering Co. Ltd.), 23, College Hill, London, E.C.
Winn, Charles, & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., East Greenwich, London, S.E.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.
Brown, Andrew, & Co., 110, Cannon Street, London, F.C.
Meguin, Fr., & Co., Ltd., Engineering Works, Dillingen-on-Saar.

Mining Machinery.
Fraser & Chalmers, Ltd., 3 London Wall Buildings, London, E.C.

Office Appliances.
Davis John, & Son, Ltd., 30, All Saints' Works, Derby.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Inglesant, T., & Sons, Ltd., Atlas House, Leicester.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rookwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

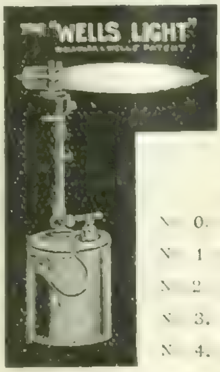
Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Oil Filters and Cabinets.
Valor Co., Ltd., Rocky Lane, Aston Cross, Birmingham.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London E.C.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United States Metallic Packing Co., Ltd., Bradford,
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C

PAGE'S WEEKLY Wells' Specialities



PORTABLE LIGHT FROM OIL

UP TO 4,000 CANDLE POWER.

Adopted by 26 Governments and all Leading Firms. Over 1,500 supplied to British and Foreign Railways.

EACH LAMP GUARANTEED.

Horizontal Flame Unaffected by Weather

OVER 18,000 SOLD

		PRICE		
No. 0.	[illegible] Candles small hand pattern [illegible]	£7	7	0
No. 1	[illegible] Candles hand pattern, with No. 2 size burner for Tar Oil ...	£10	0	0
No. 2	1,500 Candles useful and portable pattern	£15	10	0
No. 3.	2,500 Candles, Manchester Ship Canal pattern	£16	10	0
No. 4.	[illegible] Candles. A most powerful lamp...	£17	15	0

These Lamps are [illegible] Kerosene [illegible] Petroleum [illegible] Companies [illegible] Great Britain our Special Wells' O[illegible] [illegible] perfect, [illegible] light. Special [illegible] oil may be had on application to our Agents or direct to us.

No. 50 "STANDARD" LAMP.

For Electrical Engineers, Contractors, Builders, Docks, Railways, &c.

The Lamp [illegible] produces [illegible] about [illegible] candle power [illegible] [illegible] holds [illegible] burning six hours.

Price **£3** [illegible]

Extra Burners **3/-** each.

WELLS' "STANDARD" OIL GAS LAMP NO 50

WELLS' "LIGHTNING PAINTER."

([illegible] AND WELLS' PATENTS.)

PAINTING BY MACHINE.

Great Saving in Time, Paint, and Labour.

PAINTING SPEED—3 square yards a minute.

[illegible] evenly and continuously, through [illegible] supplied with compressed air either [illegible] our special Compressor.

No. 1 Painter ([illegible] Illustration)	£25	0	0
No. 2 ,,	£30	0	0
No. 3 ,,	£35	0	0
Single Air Compressor	£17	10	0
Double Air Compressor	£27	0	0

HAND AIR COMPRESSORS, Paint Holder and Sprayer Combined.

Invaluable for ELECTRICAL WORK, STENCILLING ORNAMENTING, DECORATING, &c., or any class of painting where the work is not very heavy or continuous.

Price, Complete £16

Hand Sprayer and Hose supplied separately £9.

WELLS' OIL GAS GENERATING LAMP No. 40.

Weight, 10 lb. Capacity [illegible] pints. Burning about 7 hours.

Made in Sheet Steel with [illegible] bottom of our "Unbreakable Metal" for Lightness and Strength with [illegible] Capacity.

Price, with Single Burner..	16 [illegible]
,, Double ..	19
Tripod Stands	3
Extra Burners	2

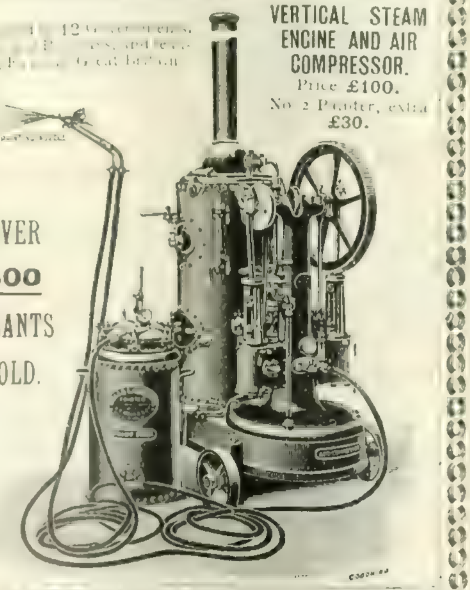
[illegible] 12 Governments, [illegible] [illegible] Great Britain.

OVER **500** PLANTS SOLD.

VERTICAL STEAM ENGINE AND AIR COMPRESSOR.

Price £100.

No. 2 Painter, extra £30.



A. C. WELLS & Co.,

100a, Midland Road, St. Pancras,

LONDON, N.W.

Buyers' Directory—(*Continued*).

Photo Copying Frames.
J. Halden & Co., 8, Albert Square, Manchester.
F. J. [illegible] & Co., [illegible] Street, London, S.W.

Photographic Apparatus.
[illegible] Soho Square, London, W.

Pinch Bars.
[illegible] & Co., [illegible] Leeds.

Pipe Wrenches (Chain).
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Pneumatic Tools.
Consolidated Pneumatic Tool Co., Ltd., Palace Chambers, Bridge Street, Westminster, S.W.

Porcelain.
Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.
Drum Engineering Co., 33, Brook Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.

Radial Drilling Machines.
Asquith, William, Ltd., Well Road Works, Halifax.
Greenwood & Batley, Albion Works, Leeds.
Mitchell, D., & Co. Ltd., Parsonage Works, Keighley.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund, Ltd., Felling-on-Tyne.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.
Swift, George, Clarence Ironworks, Halifax.

Rails.
Wm. Firth, Ltd., Leeds.

Riveted Work.
F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roller Bearings.
Hyatt Roller Bearing Co., 47, Victoria Street, London, S.W.

Roofs.
D. Anderson & Son, Ltd., Lagan Felt Works, Belfast.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.
McTear & Co., Ltd., Newtownards Road, Belfast.

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Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.
[illegible], Germany.

Scientific Instruments.
Cambridge Scientific Instrument Co., Ltd., Cambridge.

Slotting Machines.
Swift, George, Clarence Ironworks, Halifax.

Spanners.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stampings.
Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

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Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).
Edward Pryor & Son, 68, West Street, Sheffield.

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British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

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Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

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Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

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[illegible] & Co., Ltd., Stockton-on-Tees.

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Ed. Bennis & Co., Ltd., Bolton, Lancs.

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S. Pegg & Son, Alexander Street, Leicester.

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A. Bolton & Co., [illegible], Deansgate, Manchester.

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Recorders, Ltd., 171, Queen Victoria Street, London, E.C.

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Greenwood & Batley, Albion Works, Leeds.
S. Howes Co., 64, Mark Lane, London, E.C.

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Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

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Hopkinson, J. & Co., Ltd., Britannia Works, Huddersfield.
Hunt & Mitton, Crown Brass Works, Oozells Street North, Birmingham.
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Shaw, Joseph, Albert Works, Huddersfield.
Winn, Charles, & Co., St. Thomas Works, Birmingham.

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Matthews & Yates, Ltd., Swinton, Manchester.

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Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

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Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

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Samuel Denison & Son, Hunslet Moor, near Leeds.

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Ed. Brand, 35, Shakespeare Street, Manchester.

"Woodite."
"Woodite" Company, Mitcham, Surrey.

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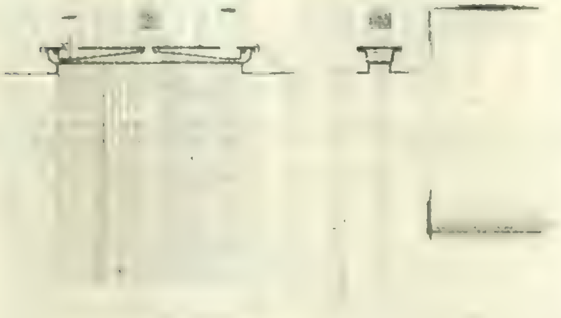

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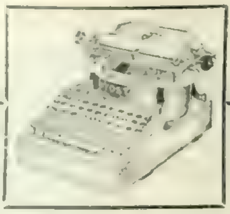

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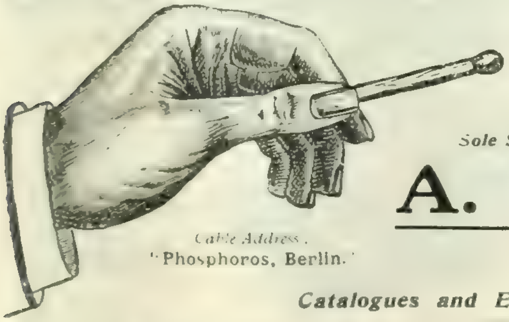

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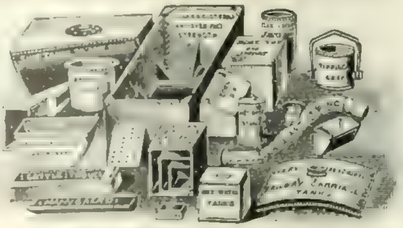

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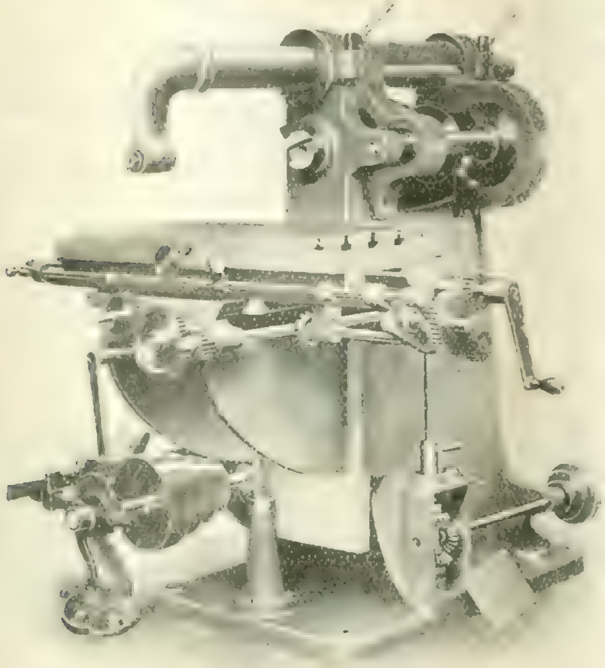

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For Milling at High Speeds

With RAPID RETURN OF TABLE

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Automatic Traverses of Table

21 inches transversely.
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With reverse motions to both feeds.

Size of Table, 2 ft. 5 in. and 1 ft. 3 in.

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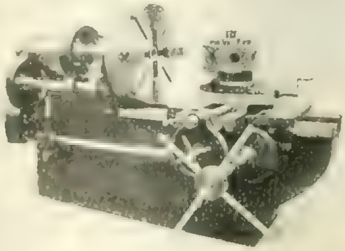

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PLATE BENDING MACHINE.

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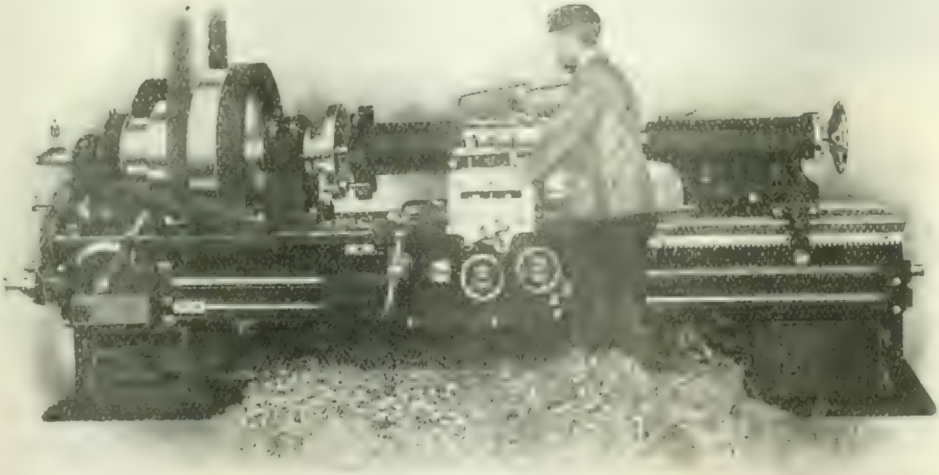

12-in. High Speed Lathe at work on Steel Forgings
at 80 ft. per minute.

If not write at once for our Lathe Catalogue.

WE CAN PUT YOU ON THE MOST ECONOMICAL FOOTING, AND INCREASE YOUR PRODUCTION.

There is no time like the present. Write now.

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PAGE'S WEEKLY Machine Tools

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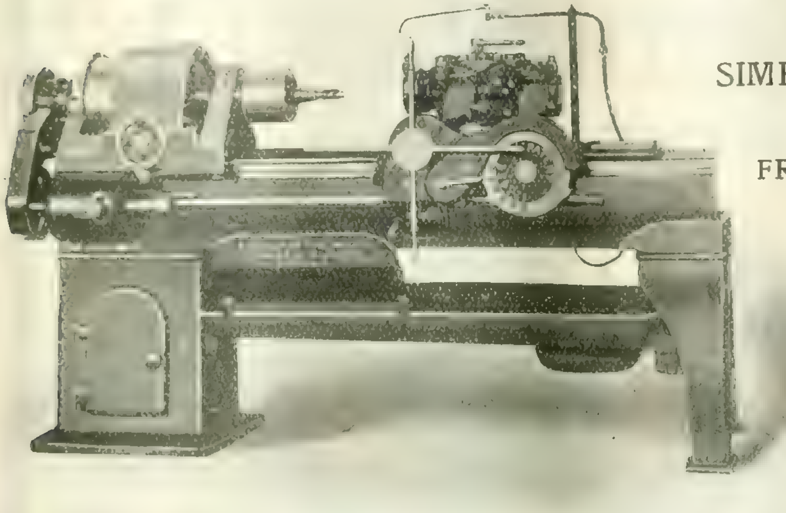

Note the
SIMPLICITY of this LATHE.

DIRECT DRIVEN
FROM THE MAIN SHAFT.

**VARIABLE SPEED
HEADSTOCK.**

The RACK and GUIDE direct under the cutting tool being completely covered.

ALL HANDLES and STOPS within reach of the Operator.
THE ONLY CORRECT GRIP CLUTCH.

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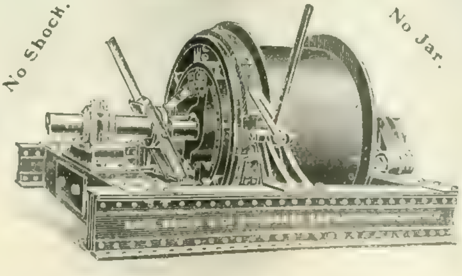
Prevents Accidents.



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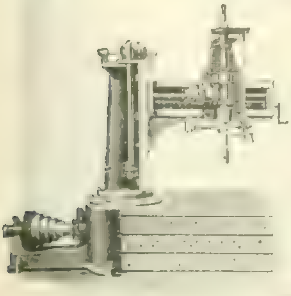
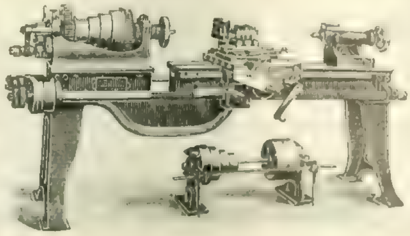
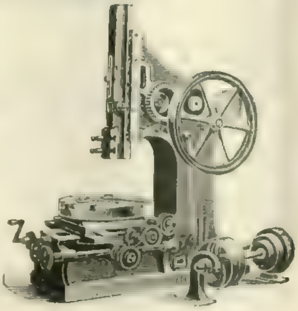
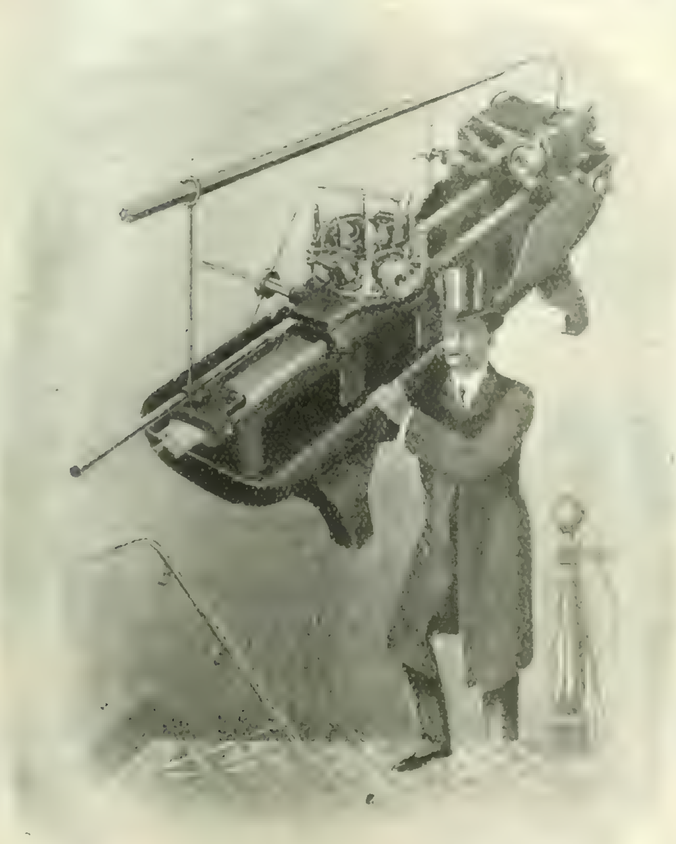






It would be Impossible



For our Representative to carry a machine on his shoulder

when he comes to interview you regarding the purchase of a Hartness Flat Turret Lathe,

But, if you will call at our premises,

97, Queen Victoria Street, London, one of our expert operators will take very great pleasure in demonstrating to you the merits of our New Model Hartness Flat Turret Lathe, with Cross Sliding Head,

☞ **The only Turret Lathe of the kind on the Market.**

COME AND SEE IT WORKING.

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"Jubilee Buildings," 97, Queen Victoria Street, LONDON, England.

TELEGRAMS: "TURRETORUM, LONDON." TELEPHONE No.: [illegible] BANK, LONDON.

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PAGE'S WEEKLY Machine Tools

Contractor to H.M. Government.

GEORGE SWIFT,

Clarence Ironworks, Halifax, Eng.

Telegrams:
"Swiftly, Halifax."
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I am, and have been the leading maker of this type of Drilling Machine for a considerable number of years, and challenge any other firm to offer an equal tool at the same price, taking output and quality into consideration. Over 3,850 machines sold.

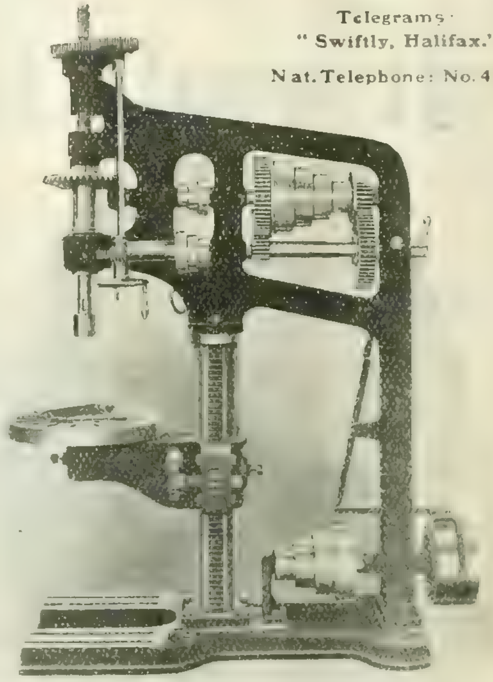

Illustration of our **30 in. Double Geared Pillar Drilling Machine No. I**, which will bore 1½ in. dia. holes, 3¼ in. deep, in fairly hard C.I. blocks in 30 seconds under ordinary conditions. Other features are: Spindles bored Morse Taper; have ball thrust; considerably more power in my machines than other makes; all cones and gears properly balanced; all wheels (except bevels) machine cut. The cheapest machines on the market, taking quality into consideration.

Made in **9** sizes, from **24 in.** to **50 in.**

Also made with Compound Table, Balanced Spindle, Quick Release, and Reversing Motion.

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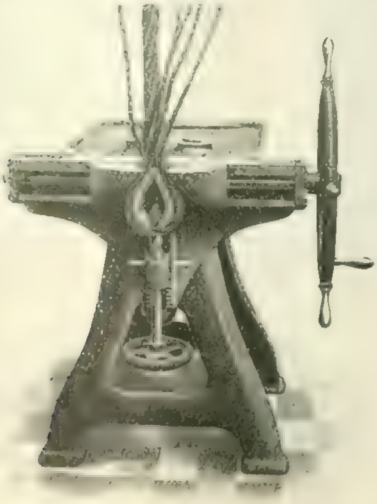

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Replete with the Highest Class of Tools.

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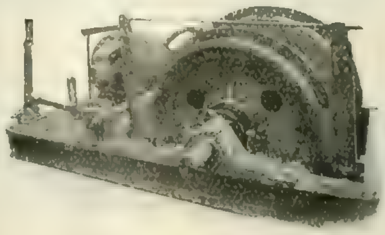

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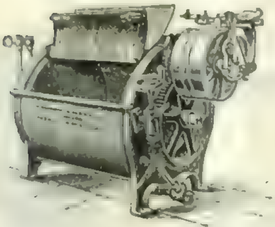

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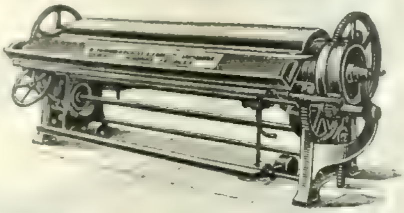
MACHINERY

and Steam COOKING APPARATUS.



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THE
JOS. C. NICHOLSON TOOL CO.
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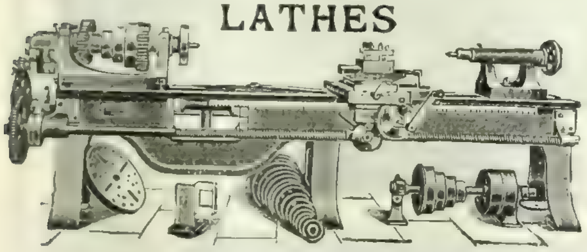

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BATEMAN THREE-SPEED PLANERS

The Machine illustrated has a variable cut of 20, 40 and 60 ft. per min., with constant return of 160 ft per min. (mean).

Send for our Speed Table.

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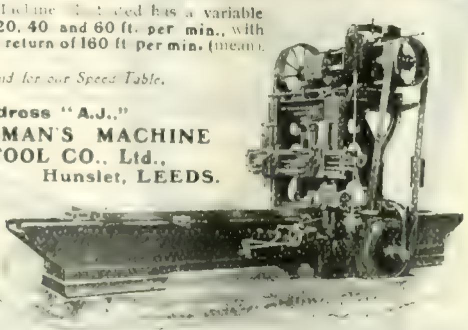

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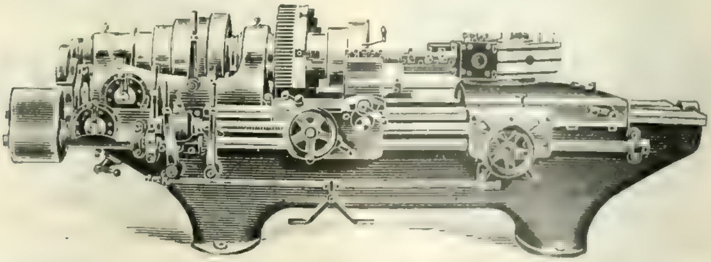
THE LATEST DEVELOPMENT IN HIGH-SPEED

TURRET LATHES

IS

BRADBURY'S RELIANCE.

It has decided advantages over any other Machine on the market,



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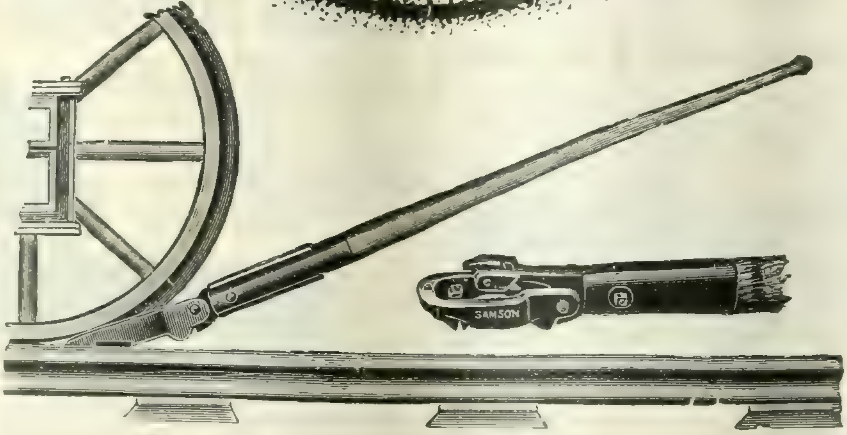
PINCH BARS.



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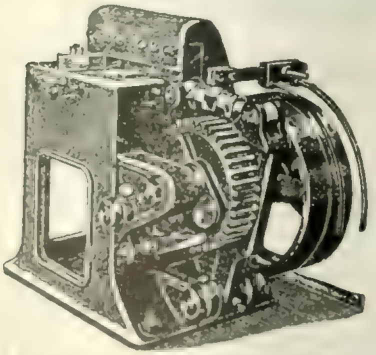

ROLLING MACHINE FOR IRON SCREW THREAD.

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Drop forgings only.
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OIL SEED AND CAKE MILLS.

GRAB DREDGERS.

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Rose, Downs & Thompson, LTD.,

Old Foundry, HULL,
and
12, Mark Lane, LONDON, E.C.

WATER SOFTENING PLANT.

FORGINGS.

Cranks and Forgings of Every Description in Stock.

See our Advertisement on December 22nd.

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The Cundall Patent Suction Gas Engine and Producer Plant.

CUNDALL, SONS, & CO., Ltd., Shipley, YORKS.

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How to deal with Inward Invoices.

Does your present system involve the looking through a mass of detail before arriving at any required invoice?
If it does, then you are wasting your time.

YOU CANNOT AFFORD TO DO THIS.

THINK OF THE SAVING

if you adopt a system that will enable you to find any required invoice at once.

YOU OUGHT TO KNOW SOMETHING ABOUT THIS.

PARTICULARS OF

The Trading & Manufacturing Co., Ltd.,
C.I. DEPT.,
27 & 28, FLEET STREET, LONDON, E.C.

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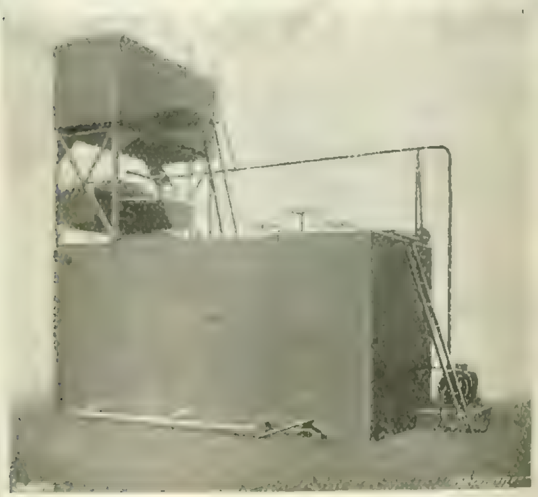

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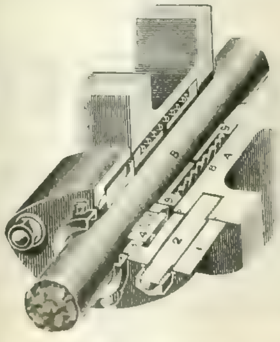

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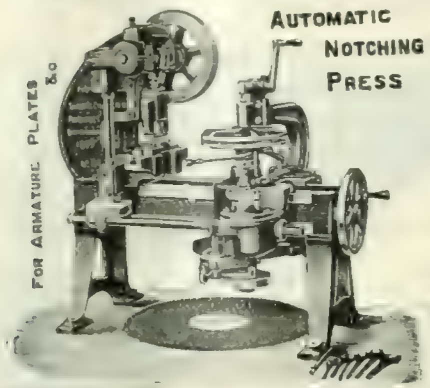

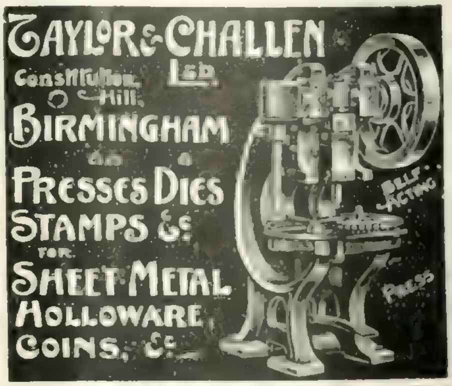
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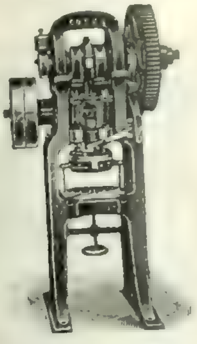
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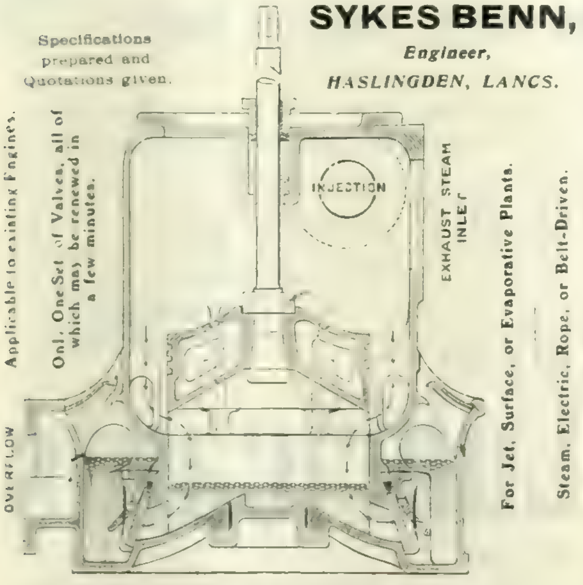

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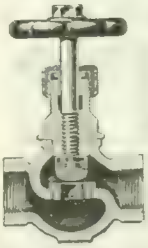

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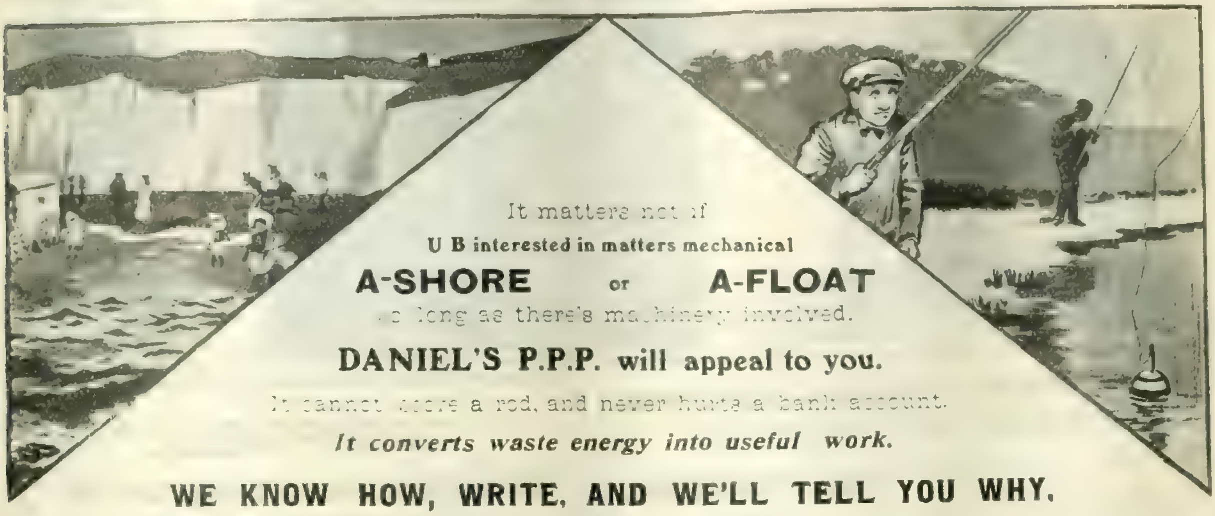

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PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

Vol. VII. LONDON, FRIDAY, DECEMBER 15, 1905. No. 66.

The Offices of "Page's Weekly," Wednesday Evening.

THE conference on smoke abatement, and the exhibition of smoke prevention appliances, opened by Sir William Richmond on Tuesday last, promises to bring in its train some practical suggestions for dealing with this national problem. Sir Oliver Lodge, who was to have delivered an address in person, on a subject he has to some extent made his own, was unable to be present, but his views having been committed to writing, were placed before the meeting by Sir William Richmond. Sir Oliver insists on the need for improved methods of burning fuel, both for domestic and manufacturing purposes. The three requisites for the improved method of burning fuel are, in his opinion (1) purification of the fuel to be consumed; (2) proper means for effecting its complete combustion without production of dust or dirt; and (3) utilization of the heat due to this combustion without waste. These three essentials of a more satisfactory method of burning solid fuel are dealt with by Sir Oliver in detail, and it is claimed that the gasification of the solid fuel, at the pit's mouth or in some central gas-producing plant, and transmission of the gas, as Mond or water gas, to the localities where it is to be used is the only method that will solve all the difficulties of the problem.

Sir Oliver Lodge gives it as his opinion that the steam-boiler, even at its best, is an unsatisfactory appliance for converting the energy of coal into mechanical energy, and that in time the use of gaseous fuel and gas engines will oust the steam-boiler and all forms of steam engine from our works and factories. The transmission of all the heat of the burning fuel through the plates of a steam boiler can, it is urged, never be

[illegible]

SIR WILLIAM B. RICHMOND, R.A.,

Who opened the Smoke Abatement Conference on Tuesday.

realised, and the conditions which best favour heat transmission are exactly those which favoured the production of smoke and flame in the furnace of the boiler. On this account the problem of the smokeless combustion of solid fuel in the case of steam-boilers is more difficult than many have yet realised. In our next issue we shall devote some attention to the important papers which are being read and discussed before the Conference.

A preliminary report has been drawn up by Mr. Dahlander, chief engineer of the Swedish Railroad Administration, upon the preparations made for experimental work with single-phase locomotives and motor cars. The Electrical World of New York states that it is an elaborate programme and one which if followed out will lead to the collection of important data on this type of apparatus. "The controlling reason for limiting the present experiments to the single-phase system seems to have been the supposed greater facility of speed control than in the case of induction motors, a factor of larger importance in the case of general railroading with much freight and local service than in interurban or similar work. It was also believed that higher voltage could be used on a single-phase trolley line than would be permissible with a polyphase construction. In view of the Zossen work one may be permitted to discount this hypothesis somewhat. However, it is just now very timely to try out single-phase locomotives, since their working properties are as yet very imperfectly known, and if satisfactory imply great developments in electric railroading. Some five or six miles of track are being equipped, and two locomotives, one from the British Westinghouse Co. and the other from Siemens-Schuckert Co., will be put through thorough tests. The experimental power station allows variation of frequency from 15 to 25 cycles and of voltage from 3,000 to 20,000, so that it should be possible to cover the working range of conditions very thoroughly.

The London County Council at its meeting on Tuesday, discussed the Bill which is being promoted to enable the Council to supply electricity in bulk to the metropolitan area. The details of the scheme have already been outlined in this journal, and it is enough to state now that the requisites of such a municipal scheme, as stated by Dr. Napier are, that the supply should be a cheap one, that it should be supplied without injury to the existing undertakings, or with as little injury as is compatible with a really cheap supply, and that such supply should be offered by a public body but with no permanent charge upon the rates. If these ideal conditions could only be realised there would be little to say in criticism of such a scheme. It is clear, however, that before such a scheme could become law, there are difficulties of a very serious character to be overcome. Not the least of the critics are to be found in the ranks of the County Council itself. It is urged that the Council is being asked to embark on a scheme involving vast expenditure without any estimates before it, and it is suggested that unless the Borough Councils co-operate it would be better to drop the Bill. Lord Welby is of opinion that the Council is in danger of overstraining its credit, and Sir R. Melvil Beachcroft has expressed the opinion that the scheme will result in a loss to the ratepayers. However, in spite of the critics, the recommendation to proceed with the Bill was carried by a large majority, and the fight for the right to supply electricity on a large scale to consumers in the Metropolis is now commenced.

It may be interesting to add a few details concerning the scheme which is embodied in the Bill. As far as technical advice is concerned, the London County Council is likely to be well served, as not only have its own officers been working out the details of the scheme for some time past, but they have retained the services, in consultative capacities, of Sir William Preece, Mr. Robert Hammond, and Mr. J. F. C. Snell.

A temporary source of energy to existing distributors would be the Council's Tramway Electricity Generating Station at Greenwich, as it is not likely that the whole capacity at this station will be called upon for tramway purposes for some years. It is in contemplation, however, to erect a generating station at Battersea, which would be the main source of supply in connection with the power scheme. It is proposed that this station should have 80,000 k.w. normal capacity, and as indicating the scope of the County Council's proposals, it may be pointed out that the area supply dealt with in the Bill comprises 387 square miles. It should be noted that the scheme is a permissive one, and the Council will not be bound to set in motion the undertaking unless it were assured that it is likely to be a financial success.

Considerable interest attaches to the St. Neots power scheme referred to in our last issue, under its proper title of "Additional Electric Power Supply London Bill." As will be seen from the announcement which appears in this issue, a powerful syndicate has now been formed with a capital of £60,000 for the purpose of financing the passage of the Bill through Parliament. It is understood that the promoters are directing their attention mainly to giving a power supply to the great London railways in connection with the electrification of the suburban traffic, which is believed to be an event of the near future, although at the same time negotiations are pending for supplying municipal and other electric undertakers in bulk. It is stated that the railway companies are fully alive to the advantage of having a strong group of capitalists ready to provide the money for such an electric power scheme, and so obviate the necessity of the railway companies themselves adding to their capital for this purpose. It is understood, indeed, that the direction of the St. Neots company, to be formed after statutory powers are obtained, will largely consist of railway directors.

A good deal of attention has been given in these columns from time to time to the work of the Engineering Standards Committee, but these scattered references have possibly failed to convey an adequate idea of its magnitude as a whole. Since January, 1901, when the movement had its origin in a motion of Sir John Wolfe Barry, K.C.B., at a meeting of the Council of the Institution of Civil Engineers, a committee being there and then appointed to consider the advisability of standardising various kinds of iron and steel sections, a great many fields of industry have come within the scope of the Engineering Standards Committee, and it has been deemed advisable to issue a Report and Progress of Work from January, 1901, to July, 1905. From this we learn that, prior to the month last mentioned, 19 reports were published. It appears, from a tabular statement of sales, that the publications most in demand were the No. 1, List of British Standard Sections, of which 3,190 copies were sold; No. 12, Stand and Specification for Portland Cement (2,330 sold); No. 6, Properties of British Standard Sections (1,660 sold); and No. 10, Standard Tables of Pipe Flanges (1,300 sold). The smallest sales appear to have been for No. 22, Report on Effect of Temperature on Insulating Materials (32 copies sold), and British Standards for Electrical Machinery (60 sold); but it must be borne in mind that Report No. 22 was only issued during the month preceding the formulation of the Report.

Under the main committee there are now no less than thirteen sectional committees, and twenty-two sub-committees, with a total membership of 257. The following subjects have been or are now under consideration: Rolled sections, railway and tramway rails, locomotives for Indian railways, pipe flanges, screw threads, pipe threads, limit gauges, railway rolling stock material, tyre profiles, steel castings and forgings for marine work, Portland cement, cast-iron pipes, generators, motors and transformers, prime movers for electrical purposes, physical standards, telegraph and telephone material, electric cables, electric tramway material, electric automobiles, electrical plant accessories. These subjects are in various stages of completion, but it always has been recognised, from the inception of the movement, that, to avoid stereotyping present practice, revisions will from time to time be necessary. Those who wish to ascertain the exact details of the work carried on by each particular committee, are advised to write to the secretary, Mr. Leslie S. Robertson, for a copy of the report. In looking through its pages we have noted one or two points of special interest.

Having finished the question of standard sections, the sectional committee on steel for bridges and building construction turned their attention to preparing a standard specification. The draft of this specification has been submitted to the science committee of the Royal Institute of British Architects for their criticism, and will, it is hoped, be ready for publication at no very distant date.

A series of standard profiles for locomotive and wagon tyres are under consideration, and a sub-committee, working in conjunction with the Association of Railway Locomotive Engineers, is now engaged on this subject. Two or three of the railway companies have kindly turned up, and run on their lines tyres of different profiles in order to elucidate one or two points on which the sub-committee desired further information, and as soon as the results of these experiments are known, it is hoped that the standards will be issued.

It is hoped that the final report of the Sub-Committee on Generators, Motors, and Transformers will be ready for publication in the early part of next year. The report states that the list of speeds of direct-coupled steam generators agreed upon by the sub-committee on prime movers has received the adherence of the majority of engine builders, though there is even yet a tendency towards increasing the speeds decided upon. One of the most useful subjects undertaken is the standardisation of couplings, and the proposals of the sub-committee are being very well received by the trade generally. It is hoped that a set of standard couplings acceptable to the whole industry may shortly be decided upon. The consideration of carbon filament glow lamps and light standards was referred by the Electrical Plant Committee in June, 1905, to the Sub-Committee on Physical Standards, and evidence is now being gathered from the glow lamp manufacturers upon the several matters included under this heading. The co-operation of the Incorporated Municipal Electrical Association, which this sub-committee is receiving, cannot fail to be of very material assistance to them in their deliberations.

Questions relating to the standardisation of material generally are now engaging the attention of the Sub-Committee on Electrical Tramways. In January, 1903, the Electrical Plant Committee recommended the appointment of a sub-committee, under the chairmanship of Mr. C. H. Wordingham, the electrical engineer-in-chief to the Admiralty, to deal with electrical plant accessories, but, owing to the large amount of work in hand from other committees, the work of this committee has only just been commenced. The subjects to be dealt with will include fittings generally, central station switchboards and instruments, wiring rules, and central station rules. As regards electric automobiles, a special sub-committee is now gathering evidence from central stations, manufacturers, and users, and, should it be deemed advisable, a conference will be convened before the final report is presented.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

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MEETINGS, ETC., FOR THE ENSUING WEEK.

FRIDAY, DEC. 15.—Aeronautical Society of Arts, 8 p.m.: 1. Miss Gertrude Bacon, "The Acoustical Experiments carried out in Balloons by the late Rev. J. M. Bacon." 2. Mr. F. Webb, "The Aeromotive." [illegible] Mr. W. Cochrane, "A New Continuous Impulse Petrol Motor for Dynamic Flying Machines."—Institution of Civil Engineers, 8 p.m. (Students' Meeting): Mr. E. L. Mann, "Tests of Street Illumination in Westminster."—North-East Coast Institute of Engineers and Shipbuilders, Newcastle-on-Tyne, 7.30 p.m.—Junior Institute of Engineers, Westminster Palace Hotel, S.W., 8 p.m. Professor John T. Morris, "Electrical Mains for Power Transmission Work."—Mechanical Engineers, Storey's Gate, Westminster, S.W., 8 p.m.: 1. Dr. H. C. H. Carpenter, Mr. R. A. Hadfield, and Mr. Percy Longmuir, "The Properties of a Series of Iron-Nickel-Manganese-Carbon Alloys." 2. Mr. E. G. Izod, "Behaviour of Materials of Construction under Pure Shear."—Physical, Royal College of Science, Exhibition Road, South Kensington. Exhibition of Electrical, Optical, and other Physical Apparatus, from 7 to 10 p.m.

SATURDAY, DEC. 16.—British Association of Waterworks Engineers: Winter meeting at Burlington House, Piccadilly, W. Papers by Messrs. C. H. Priestley, M.Inst.C.E., on "The Municipal Control of Waterworks" and J. J. Lackland, M.Inst.C.E., dealing with working costs of pumping and describing a large underground reservoir at St. Helen's, 11 a.m.

MONDAY, DEC. 18.—Institute of Marine Engineers, Romford Road, Stratford, 8 p.m.

TUESDAY, DEC. 19.—Institution of Civil Engineers, Great George Street, S.W., 8 p.m.

WEDNESDAY, 20.—Geological Society of London, Burlington House, 8 p.m.

THURSDAY, DEC. 21.—Institution of Mining and Metallurgy, Burlington House, 8 p.m.—Chemical Society, Burlington House, 8 p.m.

FRIDAY, DEC. 22.—Manchester Association of Engineers.

NEWS ITEMS.

Mr. [illegible] M.Inst.M.M., has left [illegible] to take up [illegible] Newfoundland Exploration Company [illegible].

Mr. H. M. Morgans, M.Inst.M.M., left London on [illegible] report on the Sungai [illegible], also to visit the Hutt [illegible] Ketchore, Deccan [illegible] about four months.

At the annual meeting of the Birmingham and [illegible], on Saturday last, Mr. J. A. Jeckell, manager, of the City of Coventry electric power station, was elected president for the ensuing year. Mr. Riddle, of the firm of Inniss and Riddle, City Chambers, New Street, Birmingham, was [illegible].

The following [illegible] elected to the Institution of Mining and Metallurgy since October 12th:—Members.—John Cooper, Mexico; Francis B. Jackson, [illegible] Tasmania; William F. Smeeth, S. India. Associates.—Reginald Francis, Trefriw; William S. Mann, Central America; Edwin W. Mills, Korea; Amos Treloar, Helston; Charles E. Webb, Western Australia.

At [illegible] of the Rope and Safety Catch Commission, held in the council room of the Chamber of Mines, the evidence of Mr. F. A. Bullivant, of the firm of Ballivant and Co., on the subject of winding-ropes [illegible] and traversed almost every point in the Commission's detailed schedule. Information was also elicited in regard to the best method of attaching the rope to the load.

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Large Locomotive Order.

An important addition to the railway stock of the N[illegible] Railway has just been made by twenty powerful engines being landed from the Baldwin Company of Philadelphia, that company securing the contract after competition with British and American firms. There has been a general feeling that the State should make a strong effort to manufacture its own locomotives, as it already does wagons and carriages ; a good deal of discussion locally took place as to whether it would be desirable to construct the engines in the railway workshops, as is commonly done in Great Britain, or contract for them to be built by private firms. It has finally been decided that a contract should be let for sixty engines, to be built locally in private establishments, and the Clyde Engineering Company, of Sydney, has secured the work.

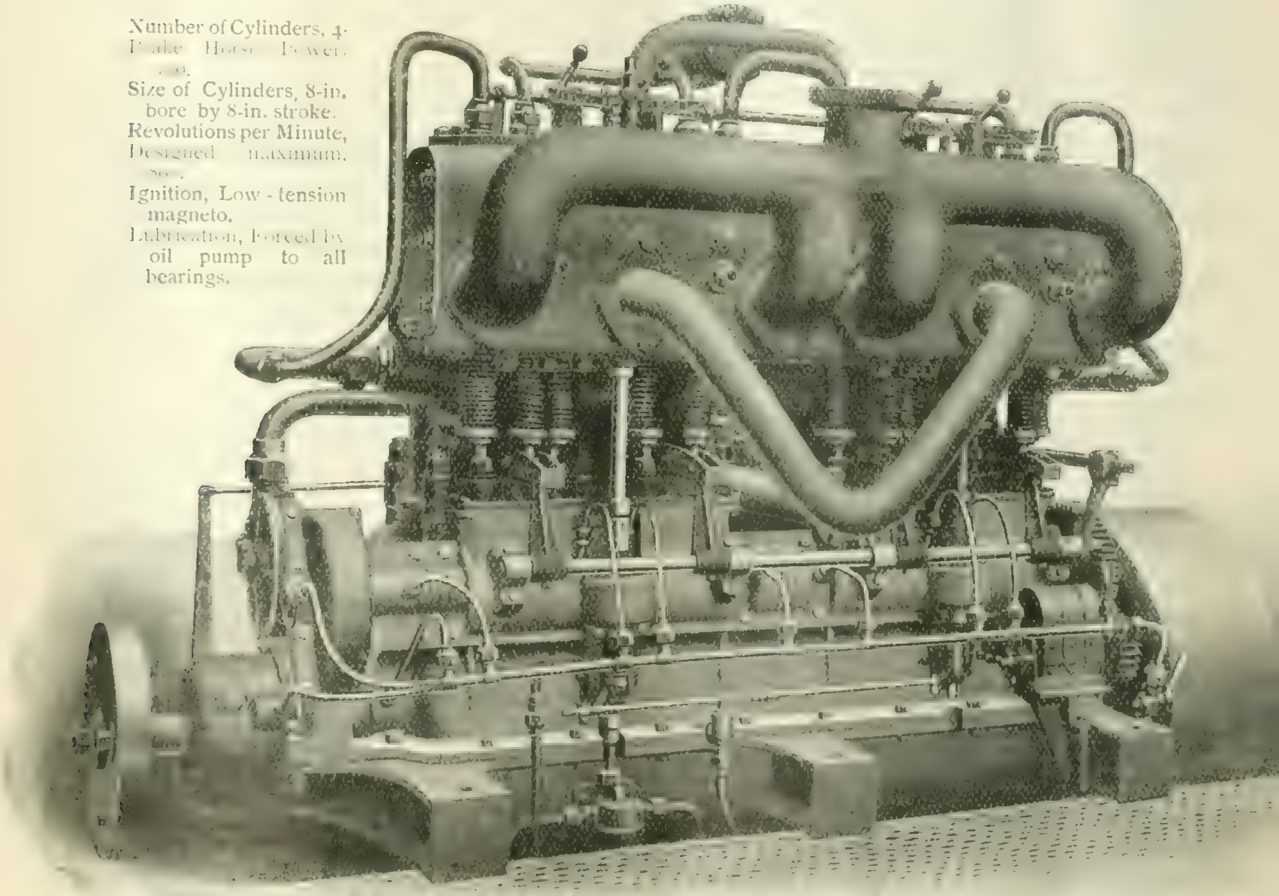
North of England Institute of Mining and Mechanical Engineers.

A [illegible] meeting of the members of this Institute was held in Newcastle-on-Tyne on Saturday, December [illegible] under the presidency of Mr. T. W. Benson.

The secretary announced that a committee had been appointed to arrange for the reception of the members of the American Institution of Mining Engineers on their visit to this district in July next.

The committee on "Mechanical Coal Cutters" presented the second portion of their report, which dealt with heading machines. It stated that the American machines most in favour in this country are the Ingersoll and the Jeffrey, which are, however, best adapted for high seams with good roofs ; the Ingersoll, though the simplest and most portable, has made but little headway in British collieries. The difficulty

Number of Cylinders, 4.
Brake Horse Power, [illegible].
Size of Cylinders, 8-in. bore by 8-in. stroke.
Revolutions per Minute, Designed maximum, [illegible].
Ignition, Low-tension magneto.
Lubrication, Forced by oil pump to all bearings.



TYPE [illegible] B.H.P. MARINE MOTOR BY MESSRS. JOHN I. THORNYCROFT AND CO. (*See page* 1340.)

[illegible] getting [illegible] work with the machines [illegible] introduction [illegible] type equipped with fixed cutter [illegible] standard, su[illegible] the Champion the Little [illegible] the Wright-Morison, and the Patterson, which are better adapted for row seams and do not require so much skill in [illegible] ation, attention is also [illegible] to the suitability of these machines for stone-work especially when shot-firing is undesirable. The chain-breast machine is chiefly used in winning-out and is adapted for Bord-and-pillar work, and rotary machines such as the Stanley header are principally used in thick seams and strong coal. The conditions under which the various machines are used together with descriptions of the machines are given.

In acknowledging a vote of thanks which was accorded to the committee, Mr. T. E. Forster stated that American coal cutters had recently been introduced into Australia with greater advantage than in this country, for the conditions there were more like those that prevailed in America.

Mr. H. W. G. Halbaum read a somewhat abstruse mathematical paper in which he contended that his theory of the normal obliquity of the great planes of strain induced by the subsidence of the absolute roof in coal mines is [illegible] perfectly natural and reasonable theory.

Mr. M. F. Holliday who, at a previous meeting, read a paper on an outbreak of fire at Littleburn Colliery, caused by an incandescent electric lamp being embedded in coal dust, submitted the results of further experiments, in which fire was obtained by placing an electric bulb on (*a*) small coal in 1 hour 20 minutes; (*b*) greasy waste in 17 minutes, the bulb covered with cotton rag caused the ignition of the rag in 36 minutes, flannelette in 8 minutes.

In the discussion which followed it was contended that electric bulbs used in mines should be enclosed in an outer casing, more particularly in view of the danger from fine coal dust in the presence of strong currents of air containing oxygen.

Society of Engineers.

The annual dinner of this Society was held at the Hotel Cecil on Wednesday night. The president (Mr. Nicholas J. West) occupied the chair, supported by the president elect (Mr. Maurice Wilson), and among those who accepted invitation were: Sir Alexander Kennedy, F.R.S., Lieut.-Col. Sydney Ashley, Mr. John Gavey, C.B. (Pres. Inst. Electrical Engineers), Mr. William Frecheville (Pres. Inst. Mining and Metallurgy), Messrs. Percy Griffith, W. W. Beaumont, Chas. Mason, J. W. Wilson, D. B. Butler, hon. treasurer, and Perry F. Nursey, secretary.

The "St. Neots" Electric Power Scheme.

[illegible] Bill [illegible] Parliament to carry out this electric power scheme. A joint stock company has been registered with a [illegible] first instance the financial necessities of the enterprise during the passage of the Bill through Parliament, and the names of the members of the syndicate which appear on the register as signatories to the memorandum of association are a guarantee that any necessary capital will be forthcoming for the ultimate construction of the electric works and mains. The signatories to the memorandum of association are:—The Law Debenture Corporation, Ltd., the Railway Share Trust and Agency Company, Ltd., the Mercantile Investment and General Trust Company, Ltd., The United States and South American Investment Trust, Ltd., the Right Hon. G. J. Shaw Lefevre, the Right Hon. J. W. Mellor, K.C., Sir James Sievewright, K.C.M.G., Sir William Mather, Sir John Gray Hill, Messrs. R. Raphel and Sons, Messrs. Stern Brothers, Messrs. Lazard Brothers, Messrs. Helbert, Wagg, and Russel, Messrs. Sperling and Co., Colonel Henry Platt, C.B., Mr. Louis Floersheim, Mr. Robert Fleming, Mr. J. G. B. Stone, Mr. George Kitchin, Mr. J. S. Bergheim, Mr. H. A. Vernet, Mr. Stanley Boulter, Mr. E. B. Merriman, Mr. G. A. Touch, Mr. Joseph Beecham. The directors of the syndicate are stated by the articles of association to be Mr. Stanley Boulter (chairman), Mr. George Kitchin, and Mr. H. A. Vernet.

Economic Conditions in South Africa.

In a recent lecture before the Society of Arts Sir William Preece referred to the economic side of the South African problem. Sir William visited the Colony with the British Association and there is force and point in many of his obesrvations. One knows that the cost of living is abnormally high, and a skilled white working man is poor on a salary of £1 per day. Rent as an item of expenditure occupies the pride of place. It is hoped that these things are going to be altered. The security of British occupation, the discovery of new mineral deposits, and the certainty of cheaper transit, especialy in municipal areas, will reduce rents and *pari passu* the necessaries and luxuries of living. Even now the thrifty man secures benefit by building his own house if he can command the capital, and the master aids his labour by building workmen's dwellings. The Central South African Railway administration has done this to a large extent and thereby has secured a lien upon their men which make for discipline, faithful service, and long service. This also is at the root of the extremely efficient compound system applied to coloured labour.

Presentation of Souvenirs.

[illegible] the programme of to-night's Electro-harmonic Smoking Concert will be the presentation of souvenirs to the members of the Electrical Exhibition Executive Committee. The success of the show at Olympia was largely due to the good work of Mr. Cunliffe Owen and his committee; and the exhibitors, desiring to express their thanks and appreciation, have chosen this method. Mr. John Gavey, C.B., president of the Institution of Electrical Engineers, [illegible] selected to make the presentation at the concert to be held at the King's Hall, Holborn Restaurant, to-night.

Machine Design.

Mr. [illegible] of Stockton, in the course of an interesting and instructive paper read before the Cleveland Institution of Engineers on "Design and Safety of Machinery," averred that the nature and strength of materials were practically known and constant quantities, but design was an ever-changing quantity, and faulty design was undoubtedly a far greater source of disaster than defective material. Many of the so-called mysterious and unaccountable failures of parts of machinery which had found no solution by chemical analyses or mechanical tests, could be accounted for by faulty design; faulty design including a selection of unsuitable material.

The Stirling Boiler Company, Ltd.

Mr. John Cowan has resigned the managing directorship of the Stirling Boiler Company, Ltd., of Motherwell, and 25, Victoria Street, Westminster. The directors have appointed Mr. E. G. Constantine, A.M.Inst.C.E., M.I.Mech.E., of Manchester, to be managing director, and he will enter upon his duties at Motherwell on the 1st prox. Mr Cowan still retains his interest in the company, and will continue to be chairman of the directors.

OBITUARY.

The death is announced of Mr. L. J. Seargeant, late general manager of the Grand Trunk Railway. He first became associated with the company in 1874, when he held the position of traffic manager, and he succeeded Sir Joseph Hickson as general manager of the line in 1891. His control of the system was a great success, and in the year in which he left Canada to join the board of the company in London, the railway was carrying annually three times as many passengers and four times as much freight as at the time when he first became connected with it.

Tramway and Light Railways Convention.

[illegible] preliminary list of topics to be considered by the International Tramway and Light Railways Association at its convention at Milan, Italy, next September, has just been published. It is as follows:—First section—topics for general discussion—Regulation of direct-current motors; advantages and disadvantages of different kinds of brakes used on urban electric railways; the proper type of cars for urban railways, especially the most desirable length; the maximum desirable speed for interurban railways operating on the highway or over their own right of way; track construction for suburban railways, especially (*a*) the proper length of rail; (*b*) the use of welded joints, such as the Falk, Goldschmidt, etc.; (*c*) the maintenance of joints; (*d*) methods of preventing the bolts giving out.

Second section—topics for reports.—Turbines for electric railway power stations; progress of electric traction for urban and interurban railways; gas engines for electric railway power stations; track construction for urban railways; advantages and disadvantages of sectionalising the electric distribution system of urban railway; the use of wattmeters on city cars; and feed-water purification for locomotives on interurban railways using steam power.

The West of Scotland Iron and Steel Institute.

The following have been elected members of the West of Scotland Iron and Steel Institute:—George D. Macdougall, mechanical superintendent, Dominion I. and S. Co., Sidney, C.B.; William Brown, chemist, 90, Whitney Avenue, Sidney, C.B.; J. C. Mackley, superintendent blast furnaces, Dominion I. and S. Co., Sidney, C.B.; B. J. Work, superintendent of coke ovens, Dominion I. and S. Co., Sidney, C.B.; John W. Fraser, superintendent O.H. Department, Nova Scotia S. and C. Co., P.O. Box 258, New Glasgow, Nova Scotia; Joseph Keay, superintendent rolling department, Nova Scotia S. and C. Co., New Glasgow, Nova Scotia; W. D. Jones, superintendent of mills, Dominion I. and S. Co., Sidney, C.B.; James A. Anderson, manager, J. G. Stein and Co., Ltd., Castlecary, Scotland; J. V. Robinson, engineer, 34, West George Street, Glasgow; James A. Gardiner, metallurgical chemist, 523, New City Road, Glasgow.

A company has been formed to erect a transporter bridge across the Tees from Middlesbrough to Port Clarence, and also to construct in connection with it a light railway or tramway from Middlesbrough to Port Clarence, Billingham, Cowper Bewley, Greatham, Seaton Carew, and West Hartlepool.

TECHNICAL SOCIETY NOTES.

Ore flotation processes occupied the attention of the Faraday Society on Tuesday evening last. Mr. James Swinburne and Mr. G. Rudorf dealt with the physics of the subject. It will be remembered that concentration of sulphide ores by flotation was introduced by Potter in [illegible], though concentration by means of oil had been already invented by Elmore. The Elmore process, however, is not a flotation process in the same sense. The process is carried out by treating the crushed ore with a suitable solution, such as a strong solution of acid sodium sulphate, at a suitable temperature, which is near the boiling point of water. Part of the ore then rises to the top, and is skimmed off, or otherwise separated, and this forms the concentrate. The explanation generally given is delightfully simple. It is said that the acid liberates hydrogen sulphide from the sulphides, and the gas then sticks to the particles and carries them up. As the acid does not act on the gangue, which in such cases is largely silicious material, the gangue is not carried up; and thus the separation takes place.

That theory does not, say the authors of the paper, fit the facts, and it seems probable that the whole matter is merely a question of capillarity, or rather of adhesion and surface tension effects. They suggest that the selective flotation is due to the presence of "greasy" sulphides, which have small adhesion, and that a high temperature is necessary to reduce the adhesion enough for the bells of gas to stick. It seems necessary that the gas should be produced at the surface of the particles themselves; and it is, in fact, produced by the decomposition of carbonates due to slight weathering of the ore. If an ore that can be floated is treated with acetic acid to remove the traces of carbonate, it cannot then be floated again. The air-film also plays an important part; and if an ore is thoroughly washed or boiled in water to remove the air-film, it cannot be concentrated with acid. Some ores, such as stibnite and molybdenite, appear to have enough air on their surfaces to form a mixture of air and steam at a temperature below boiling point, which has enough volume to float the particles. Acid is therefore unnecessary in such cases. Of the various ores and sulphides the authors have tried in dilute acid or acid sulphates of soda, the following are the most easily floated, in order of merit: Molybdenite, stibnite, galena, mixed zinc—lead sulphides, such as the Broken Hill ores, copper glance, zinc blende, and iron pyrites. But the last two scarcely float at all.

Prof. A. K. Huntington read a paper dealing with the same problems. He pointed out that flotation processes had been successfully applied in practice in further concentrating the metalliferous portion of certain tailings produced in the sulphide ores of the Broken Hill district. What had to be accounted for was the mechanism of the adhesion of the gas bubbles to the sulphide particles which was characteristic of flotation processes, both Potter's and Delprat's. His experiments had established three things: (1) That CO_2 was evolved from the gangue and attached itself to the sulphides, floating them up to the surface; (2) that the CO_2 as it escaped from the solution carried a charge at [illegible] with it, and the solution was found to be oppositely charged; (3) that the gas or the fog in the bubble gave up its charge very slowly, and could not therefore be easily neutralised. He had also made experiments in relation to the possibility of making the sulphides float by means of air or CO_2 passed through the sulphides with or without previous electrification. No perceptible selective flotation could be obtained, and he had been unable to obtain any evidence that the electrification played any part in the flotation.

On the subject of the theory put forward in Mr. James Swinburne's paper, some criticisms were offered by Prof. Huntington. He claims that it is not necessary that the ore should be weathered, or that the gas should be generated on the surfaces of the sulphide particles. He adds that his experiments clearly showed that the presence of an air-film is not necessary in order to obtain flotation of the sulphides on the tailings. He also details an interesting experiment on mixing [illegible] equal bulks of a lightish red sand with the mineral, the whole of the blende floated in all three cases giving a very good coherent scum. He substituted for it magnetite and obtained a precisely similar result. The only way he can account for this result is by assuming that when there is insufficient gangue, the sulphides overload the bubbles and fall off them before they reach the surface, but is not altogether satisfied with this explanation. On the other hand, he has found that in the case of vanner tailings giving a very good flotation, a bad flotation might be brought about by the addition of a large quantity of sand. In this case the sulphides appear to be too much diluted with inert matter.

These results have practical importance, as they show that a certain ratio is necessary between the [illegible] material, and that as a rule it will be necessary that the ore should undergo suitable dressing operations before being treated by the flotation process. He has recently tried to float a sample taken from a solid lump consisting of practically nothing but blende and galena, and failed until sand was added. The Broken Hill vanner tailings appear to be ideally suitable for the flotation process. These experiments, claims Prof. Huntington, dispose of Messrs. Swinburne and Rudorf's contention that blende scarcely floats at all, and incidentally of the statement that "zinc sulphide is thus easily raised by galena when intimately associated." In any case, he states it is difficult to see on what grounds they made that statement. He suggests that whether a given substance can be floated or not by the process under consideration depends on the angle of contact which the solution makes with the substance as a free surface, and that the free surfaces are supplied by the gas bubbles which as they are generated come into contact with the mineral particles. Actually the bubbles are usually coated with a number of fine particles. In any case, says Prof. Huntington, once the bubble has impinged on the solid—always supposing that the solid is not completely wetted—it cannot be detached except by the application of extraneous force, such as, for instance, agitation. The less the wetting the greater will be the force required to detach the bubble. If the surface of the solid is wetted, then the bubble has no attachment at all.

The Physical Society is substituting for one of its ordinary meetings to-night, what promises to be an interesting exhibition of electrical, optical, and other physical apparatus. The exhibition, which is to be held at the Royal College of Science, South Kensington, is being contributed to by some of the best known firms of instrument makers, including the Cambridge Scientific Instrument Company, Messrs. R. and J. Beck, Ltd., Messrs. Crompton and Co., Messrs. Everett Edgcumbe, Messrs. Hilger, and Mr. R. W. Paul. Demonstrations are to be given at intervals which should add to the interest of the exhibition. It is understood there will be included one or two new instruments, which have not been seen in public before. Invitations have been issued to members of the Institution of Electrical Engineers, the Röntgen Society, the Optical Society, and the Faraday Society, and admission will be by ticket.

The important paper which Mr. Patchell read before the Institution of Electrical Engineers last Thursday, is bound to command a good deal of attention, coming, as it does, from a man of Mr. Patchell's experience, and dealing, as it does, with the equipment of an important London central [illegible] it is likely to open up a valuable discussion on the subject of central station practice appears extremely probable. Already there are indications that Mr. Patchell's paper is certain to be strongly criticised. Mr. Sparks, who is well-known as an authority on central station practice, has expressed surprise that the Charing Cross Company burning small Welsh coal almost exclusively, is not able to show a more economical coal consumption than something under 4 lb. per unit. A report of yesterday's discussion will appear in our next issue, and readers are meanwhile referred to the instalment of the paper itself, which appears to-day.

The programme of the Royal Institution lectures after Christmas includes several of engineering interest. Professor Arnold is to deal with the internal architecture of metals, Sir Andrew Noble is to discuss difficult questions in connection with explosives, Professor J. J. Thomson will deal with some applications of the theory of electric discharge to spectroscopy, while Professor Silvanus P. Thompson will lecture on the electric production of the nitrates from the atmosphere. Other lectures already announced are: "The passage of electricity through liquid," by Mr. W. C. Dampier Whetham, and "Internal combustion engines" will be treated by Professor B. Hopkinson in a course of three lectures.

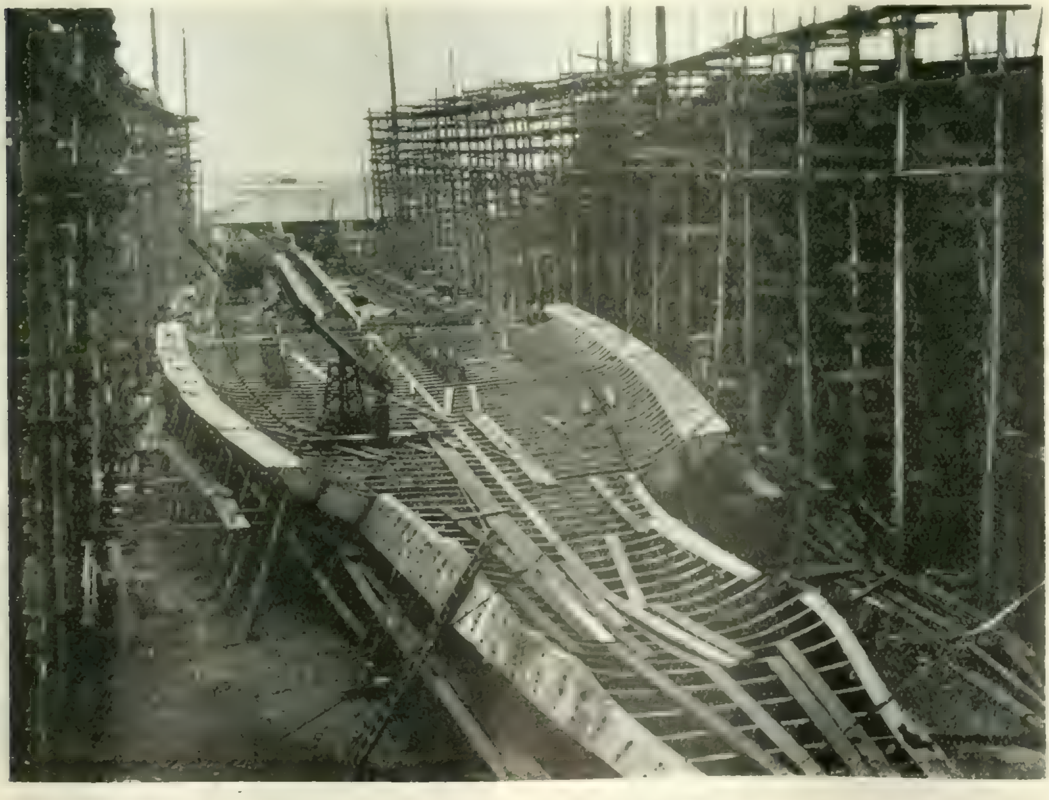
At a meeting of the Institute of Sanitary Engineers, held on December 6th, Mr. A. Alban H. Scott read a paper on "Armoured Concrete in relation to Factory Construction." The author said that comparison was often made between American and British workshops. He was of opinion that modern shops in England compared favourably with American workshops, and were far superior to the majority of Continental factories The practical advantages of armoured concrete were now well known, there being about fifty different systems. It was to be regretted that the by-laws in this country did not permit of economic building in this material owing to the excessive thicknesses required, and the necessity of our local authorities framing by-laws acknowledging and governing the construction of armoured concrete buildings was becoming every day more urgent At the same time the material itself should be made the subject of fresh research. Armoured concrete, used for constructional purposes, had qualities which required to be very searchingly investigated before theoretical formulæ, which always conduced to economy, could be set down. At present empirical formulæ were almost exclusively employed for the purpose of calculating armoured concrete work.

THE TURBINE STEAMSHIP "CARMANIA."

WE stated in our issue of the 1st inst. the main features of the latest addition to the Cunard Fleet. By courtesy of Messrs. John Brown and Co., of Clydebank, we now reproduce a photo of the vessel under steam, and another showing the hull in an early stage of construction. While the *Carmania* represents the most recent advance in turbine construction, she is also replete with every detail necessary to the comfort of passengers. With the exception of her turbines she is practically a replica of the *Caronia*, driven by reciprocating engines, and the performances of these two vessels are expected to yield very valuable data as to the relative efficiency of the two methods of propulsion.

The turbine machinery, as already stated, consists of one high-pressure turbine placed on the centre line of the ship, and two combined low-pressure and astern turbines placed in the two wings respectively. Owing to the large power to be developed, and the consequent unusual size of the turbine casing, very special arrangements have been made to prevent distortion, and also to allow for expansion. This is only one of many instances where the utmost experience and care were necessary to ensure perfect operation. The turbine drums, the shafting, and the steel castings have been manufactured at the Sheffield works of the builders' firm. Altogether, some 1,115,000 turbine blades were employed. The main condensers are cylindrical and the circulating water is supplied by two powerful centrifugal pumps, each of the pumps having two engines in connection therewith. Every detail in the steam plant is of a type to ensure a high economy, as well as reliability in working.

The turbines, on account of having to run at such relatively low revolutions, 185 per minute, are four times the size of anything yet constructed; the low



THE "CARMANIA" UNDER CONSTRUCTION. [illegible] THE INNER BOTTOM FRAMING.

[illegible] being 14 ft. outside diameter [illegible].

The boiler installation includes eight double-ended and five single-ended boilers, working in all cases at a pressure of 195 lb. per square inch. These are arranged in two separate boiler rooms, and the exhaust gases pass through two elliptical funnels, which rise to a height of 135 ft. above the level of the furnace. The boilers are fitted with Howden's system of forced draught, supplied by two large fans, each driven by two engines.

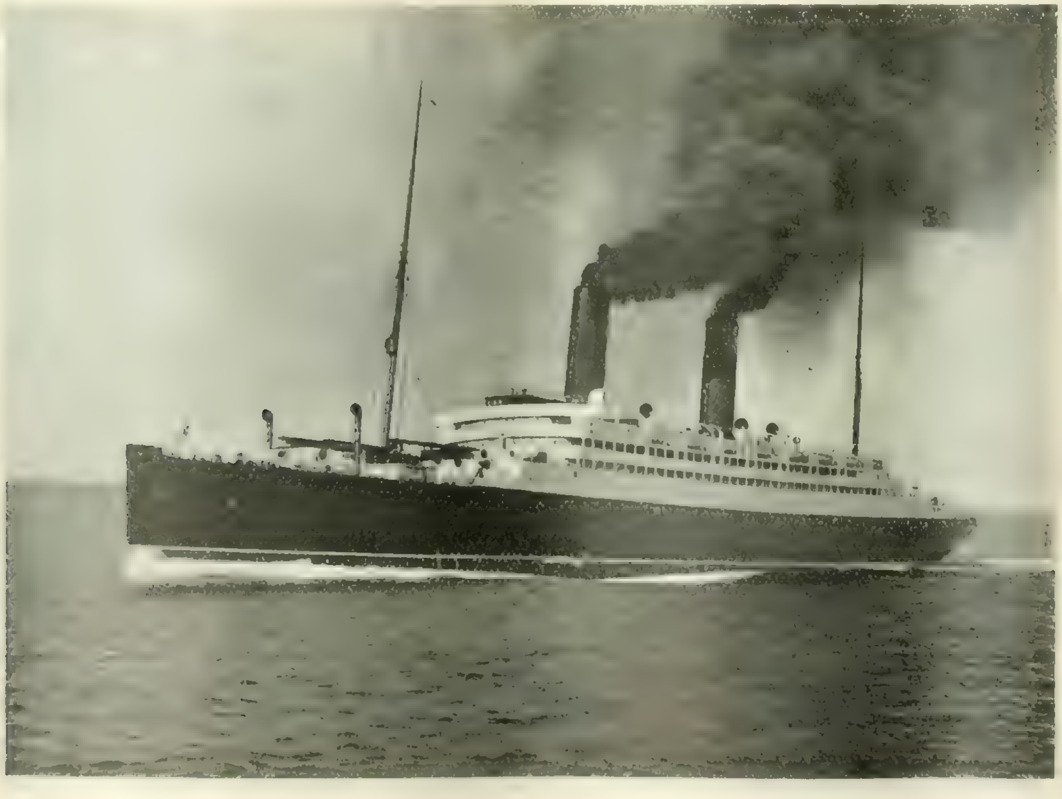
The navigating and deck machinery is necessarily of a powerful character. There are two steering engines of very heavy proportions, one under the waterline, so that there is little chance of this important item of the navigation of the ship being affected by gun shot when the vessel is used as an armed cruiser; the other steering engine is placed on a higher level. The rudder stock is extended up to the highest gear, but can be operated by either of the two steering engines. The capstan and windlass gear for working the heavy anchors are probably the heaviest that have been fitted to any merchant ship.

In the *Carmania*, as in the *Caronia*, the noise and annoyance connected with the dumping of the ashes has been removed by the adoption of "Crompton's" atmospheric silent hoists.

The principle of driving the auxiliary machinery by electric motors has been developed to a considerable extent, and special attention has been given to the disposition of fans for the ventilation of the extensive passenger compartments.

One of the most striking features of the boat deck of the *Carmania* is the big display of ventilators, and in this, as in all other departments connected with details of the ship's fittings the keenest attention to efficiency is noticeable. The ventilating apparatus adopted is that of Messrs. John Gibbs and Sons, of Duke Street, Liverpool, whose waterproof ventilators are in use already on several vessels of the Cunard Company.

The writer personally had some experience of these waterproof ventilators on his last trip across the Atlantic, having found them very satisfactorily installed on the s.s. *Lucania*. The fact that the Cunard Company are continuing to use them in the new



THE "CARMANIA" UNDERGOING HER TRIALS.

[illegible] further comment on our part needless.

The *Carmania* [illegible] the distinction of [illegible] the largest vessel yet built of her speed, and the largest which has yet been completed with turbine engines. The hull is built to Lloyd's highest class, and the standard of strength and material exceeds the exacting specifications laid down by that body and of the Board of Trade. The exterior appearance of the ship is strikingly handsome. She carries two tall masts, has two oval funnels of majestic propertions, and her promenade decks, rising above one another, suggest colossal strength.

In addition to the usual telegraphs and telephones from the navigating bridge to the engine-room, the after bridge, and to the bow, there is an installation for the control of the whole of the watertight bulkhead doors. These doors are fitted on the Stone-Lloyd principle, and can at the will of the captain be closed throughout the ship in a few seconds, thus rendering the vessel practically unsinkable.

Another interesting instrument fitted here is a submarine telephone, an appliance for locating the position of lightships or lighthouses in foggy or thick weather, by means of sound waves through the water. By this appliance, which is fitted on all the New York and Boston passenger vessels of the company, a submarine signal recently was distinctly heard at a distance of nine miles.

The officers' quarters are fitted immediately below the bridge at the forward end of the boat deck, thus ensuring that all officers are within call when off duty. On this deck is fitted the Marconi Wireless Telegraphic Cabin, forming a link by which the ship is in touch throughout the voyage with England or America, receiving news or messages for passengers daily.

The ship left Clydebank on Tuesday, 14th ult., for the Tail of the Bank, and on the same day made the preliminary trials at moderate speeds, which were quite satisfactory.

On the following day progressive trials were made reaching a maximum average speed on two runs on the measured mile of over 20 knots.

On Tuesday, the 21st ult., another six hours' continuous trial was made, the average speed being 19½ knots, which was easily maintained throughout the whole trial, and which exceeded the speed required by the specifications.

The smooth running of the machinery throughout the trials was most satisfactory to both builders and the Cunard Company.

During the trials great interest was felt in the behaviour of the vessel at full speed in the somewhat [illegible] the Bank, the remarkable steadiness of the ship being the subject of universal comment. This lack of vibration, added to the absence of the noise usually experienced in vessels fitted with reciprocating engines, undoubtedly gives to turbine boats a great advantage from the point of view of the traveller. There seems to be a general consensus of opinion that Messrs. John Brown and Co., the Cunard Company, and the Hon. C. A. Parsons are alike to be congratulated upon the successful completion of a remarkable enterprise.

A [illegible] correspondent telegraphed on Tuesday that in spite of severe weather during the entire voyage, the [illegible] steamship *Carmania* arrived at New York on Sunday on schedule time, but did not dock until Monday, owing to a storm, which made it impossible to [illegible]. Everybody in the *Carmania* was delighted with the vessel. Experienced passengers said that though the passage was the roughest they had ever known there was never a moment of discomfort. The absence of vibration was complete even during the severest gales, and when racing speed was being maintained. Several engineering experts made the voyage in the *Carmania* and all were enthusiastic about her.

MINERAL OUTPUT OF SOUTHERN RHODESIA.

The following figures of the mineral output of Southern Rhodesia during the year ended March 31st, 1905, with comparative figures for the preceding year, are extracted from the recent report of the Directors of the British South Africa Company :—

	[illegible]		1904–5	
	Quantity.	Value.	Quantity.	Value.
	[illegible]	[illegible]	oz.	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	tons.	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	*	[illegible]	[illegible]†
[illegible]		—	—	[illegible]

* Value not given.

† The value of the 51,657 tons that were sold.

The output of gold from Southern Rhodesia during [illegible] September 30th, amounted to [illegible]

It is understood that the Waterloo and Baker Street Electric Railway will probably be open for traffic early in the spring.

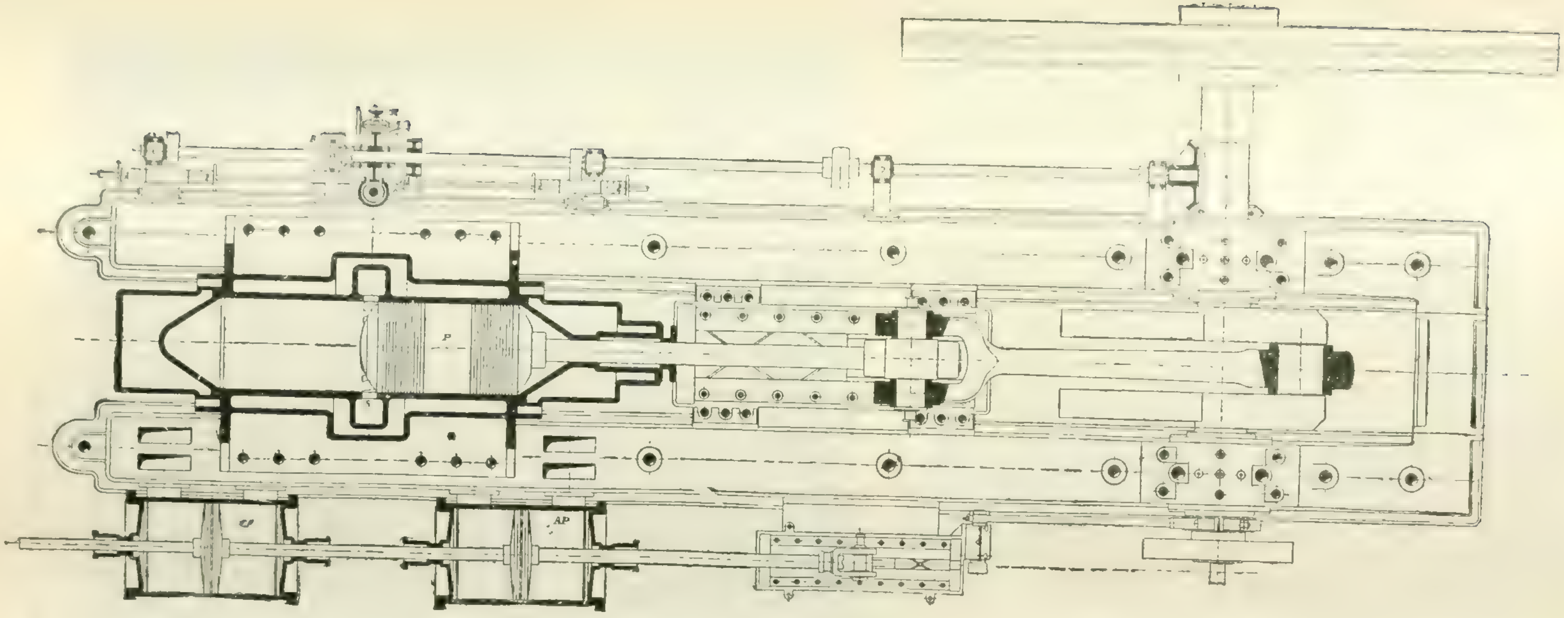


Fig. 1

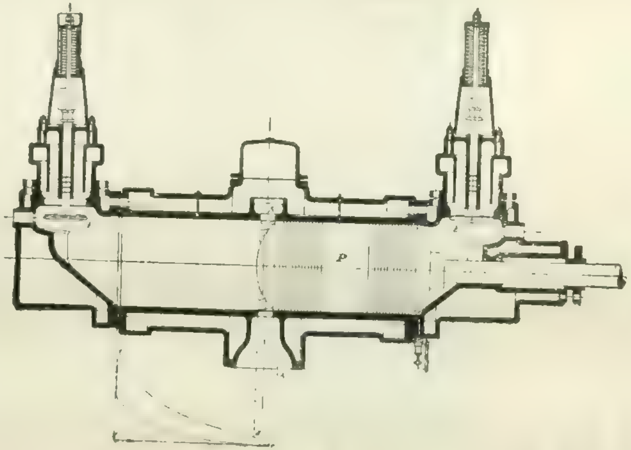


Fig. 2.

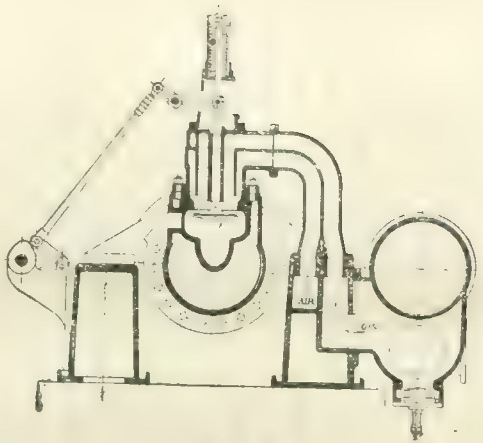


Fig. 3.

DETAILS OF THE KÖRTING GAS ENGINE.

B.	Compressed Air Starting Gear.
E.	Admission Valves.
P.	Piston.
R.	Ignition Regulating Gear.
S.	Exhaust Ports.
AP.	Air Pump.
GP.	Gas Pump.

THE KÖRTING GAS ENGINE.

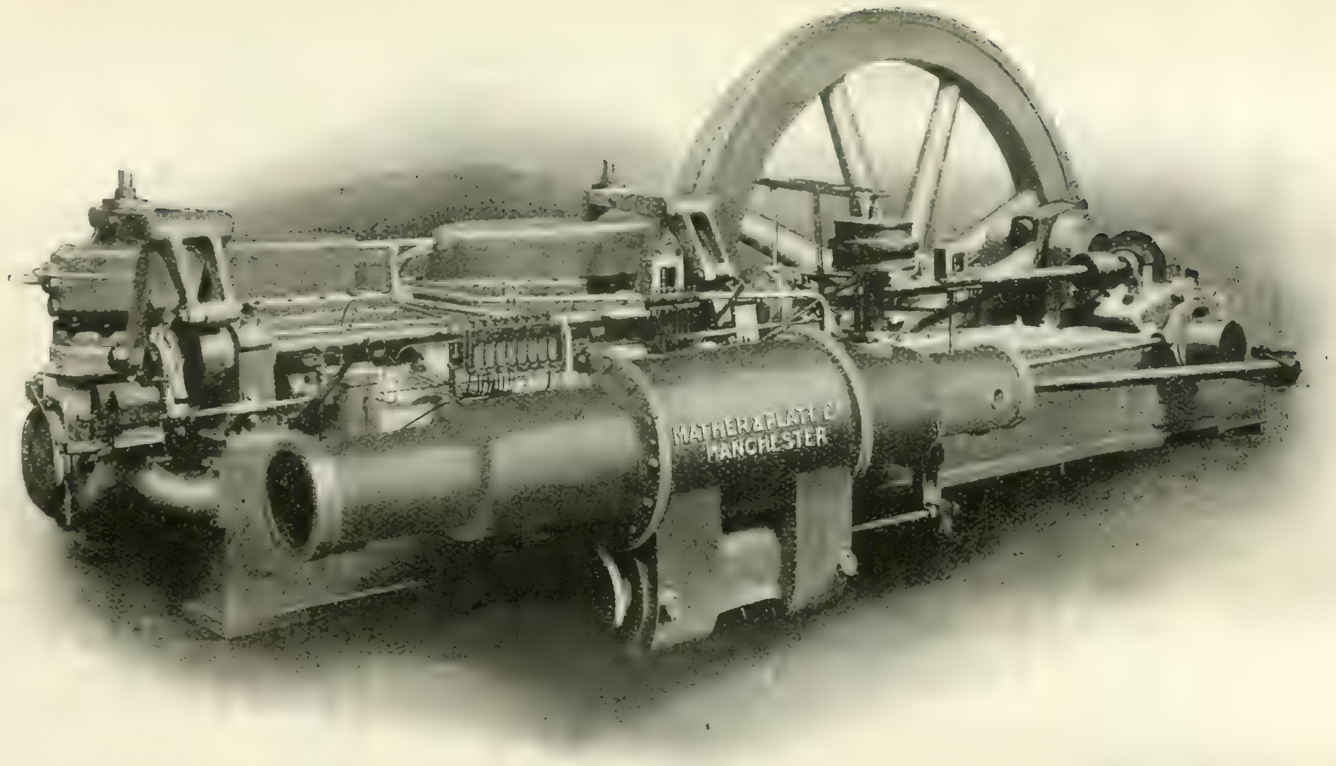
CONTINUING the review of the progress made in the construction of large power gas engines in this country, which has appeared from time to time, we reproduce on the opposite page some instructive diagrams of the Körting engine as constructed by Messrs. Mather and Platt, Ltd. The double-acting Körting engine has already been built in this country to develop 1,200 b.h.p. in a single cylinder. In this engine each side of the piston receives an impulse every alternate stroke, i.e., there are two impulses per revolution. At the front end the piston rod is carried through a stuffing box fitted with metallic packing, and is connected to an external crosshead in the ordinary way. This arrangement is of great value in an internal combustion engine, where the temperature of ignition is so enormous, as it obviates the difficulties arising from the heating of the internal crosshead-pin, which are of frequent occurence with the trunk piston engines.

The outside crosshead, while permitting of free lubrication and cool running of the pin and guides, also does away with undue wear and tear of cylinders and pistons due to the resultant of the force of the impulse and the resistance of the crank pin. The piston of this engine is long, affording a good wearing surface, and this feature, together with the external guide, ensures smooth running inside the cylinder.

Alongside the power cylinder are placed the charging pumps, for air and for gas; and it is by the adoption of these independent pumps, which in one stroke supply both the scavenging and explosive charges to the power cylinder in place of using the power cylinder itself as a pump for this double purpose during two strokes, that the engine acts on the two-cycle instead of the four-cycle system. When the piston P is on the forward dead centre, as shown in the illustration, the exhaust ports S round the centre of the working cylinder are uncovered, their opening having commenced when the face of the piston was in the position represented by *d* on the small indicator diagram (fig.). At that moment the cylinder pressure, as apparent from the expansion curve, falls to atmosphere, and at the same time the admission valve E is opened by its cam, and a scavenging charge of pure air is sent into the cylinder by the air pump, effectually clearing out the products of combustion.

The gas pump the discharge of which takes place later than that of the air pump, now sends a supply of gas into the cylinder, which discharge, mingling with that of the air pump, forms the combustible mixture necessary for the power stroke. The exhaust ports S are then closed by the return stroke of the power piston P, the mixture is compressed, ignited electrically at two distinct points, except in the smaller sizes, to ensure complete firing, and the impulse is transmitted to the piston. The same cycle is repeated at each end of the piston alternately, the air pump thoroughly sweeping all burnt products through the exhaust ports S, and thus preventing the pre-ignition of the incoming charge by contact with the hot gases remaining in the cylinders. This thorough sweeping out of the burnt products by the scavenging charge, also prevents the choking of the exhaust ports by carbonised lubricant, or by dust which may pass into the cylinder with the gas. Examination of a cylinder, after months of steady running, proved beyond doubt that the ports were absolutely clean, and that no undue wear had taken place on the bars between the ports.

A special advantage of the independent pumps is that the air and gas are kept distinct and separate till they reach the admission valve,



350-H.P. GAS ENGINE BY
MESSRS. MATHER AND PLATT, LTD.

so that there is no accumulation of explosive mixture out of the working cylinder itself. Where the value of the gas is liable to fluctuate, the variable ignition gear is of great service.

Compressed air is used to start the engine, for which purpose a small air compressor is required, the air pressure necessary being about 120 lb. per square inch.

As regards cooling, the power cylinder is completely water-jacketed, including the cylinder heads, and exhaust port belt. Circulating water is led to one side of the main crosshead, thence through the piston rod into the piston, back through a pipe inside the rod to the other side of the crosshead, and then away. The interior of the working cylinder is thus kept at a reasonable temperature, which it is quite easy to determine by means of thermometers placed in suitable positions.

THE CHARING CROSS COMPANY'S CITY OF LONDON WORKS.

By W. H. PATCHELL

CAREFUL search had been made for a site for these works near the City and the existing areas of supply, but the most favourable that could be procured was at Bow, about four miles from the Bank of England and close to the main line of the Great Eastern Railway. Here a plot of about eight acres was found with railway and water accommodation, although the latter was not sufficient for condensing purposes.

The question of system had to receive very careful consideration. The demand in the City was for direct current, and the supply in the West End, which was to be augmented, was also direct current, so that the supply to the consumer was naturally settled as direct current. The choice in this instance fell on three-phase.

In considering the question of pressure, the author decided to take the highest pressure that could be directly generated by the machines and used by the motors, as he was anxious to eliminate the complication of static transformers and to save the extra space and switchgear necessitated by them. 10,000 volts was the pressure chosen. At the time the only 1,000-volt systems in this country were in connection with the Deptford station of the London Electric Company, who were working single-phase with step-up and step-down transformers, and the Willesden station of the Metropolitan Electric Supply Company, who were working two-phase with step-up and step-down transformers. The periodicity chosen was 50 complete cycles per second.

GENERATING STATION.

The sizes of unit chosen for the generating plant were 800 kilowatts and 1,600 kilowatts. The first portion of the plant ordered included two sets of each size. The building was laid out for a boiler-room 75 ft. wide, with two rows of boilers facing each other; and an engine room parallel to the boiler room also 75 ft. wide, with 36 ft. 6 in. clear under the traveller hook.

A consideration of the tenders led to the selection of Messrs. Belliss and Morcom's high-speed vertical engines for the 800-kilowatt machines, and Messrs. Sulzer Bros.'s horizontal slow-speed engines for the 1,600-kilowatt machines. These engines would lay [illegible] centres, boiler room considerations, however, led to the adoption of 37 ft. 6 in. centres.

The existing building is 300 ft. long, and the site is sufficient for the extension of it to 500 ft., and the provision of a similar building alongside. The boilers adopted were of two sizes, both made by Messrs. Richard Hornsby and Sons, Ltd., Grantham. The smaller size had already been in successful operation at the Charing Cross Company's Lambeth Works for some years; the larger size was specially built for this work.

SECOND GRATES FOR BOILERS.

A novelty was introduced in the case of the larger boilers, where a grate was arranged in the ordinary way at the front and another at right angles to it, which could be fired from the side. These second grates have proved to be of enormous benefit when sudden fog or a thunderstorm has called for an extra supply of steam at very short notice. The ashpits for the two grates are quite separate, and are provided with the usual doors. At times of light load the boilers are fired from the front only, and the doors in connection with the side grates are all closed. A little dust falls on the bars at the back which are not otherwise protected, but do not suffer from the high temperature to which they are exposed. As soon as the demand arises coal is thrown on to the side grates, the ashpit doors opened, and the extra fires are got away with surprising rapidity. The large heating surface in proportion to the grate worked at light loads is an advantage, and the large size of boiler adopted gives much less radiating surface per square foot of heating surface than in the small sizes usually adopted.

There are also special down-comers with mud-drum and headed for the bottom rows of tubes immediately over the fire.

Each boiler is provided with its own superheater of the McPhail and Simpson's type.

LARGE BOILER UNITS.

[illegible] has always been an advocate of large boiler units, both on the grounds of economy and convenience.

The development of Messrs. Hornsby's "Upright" type presented further possibilities in this respect.

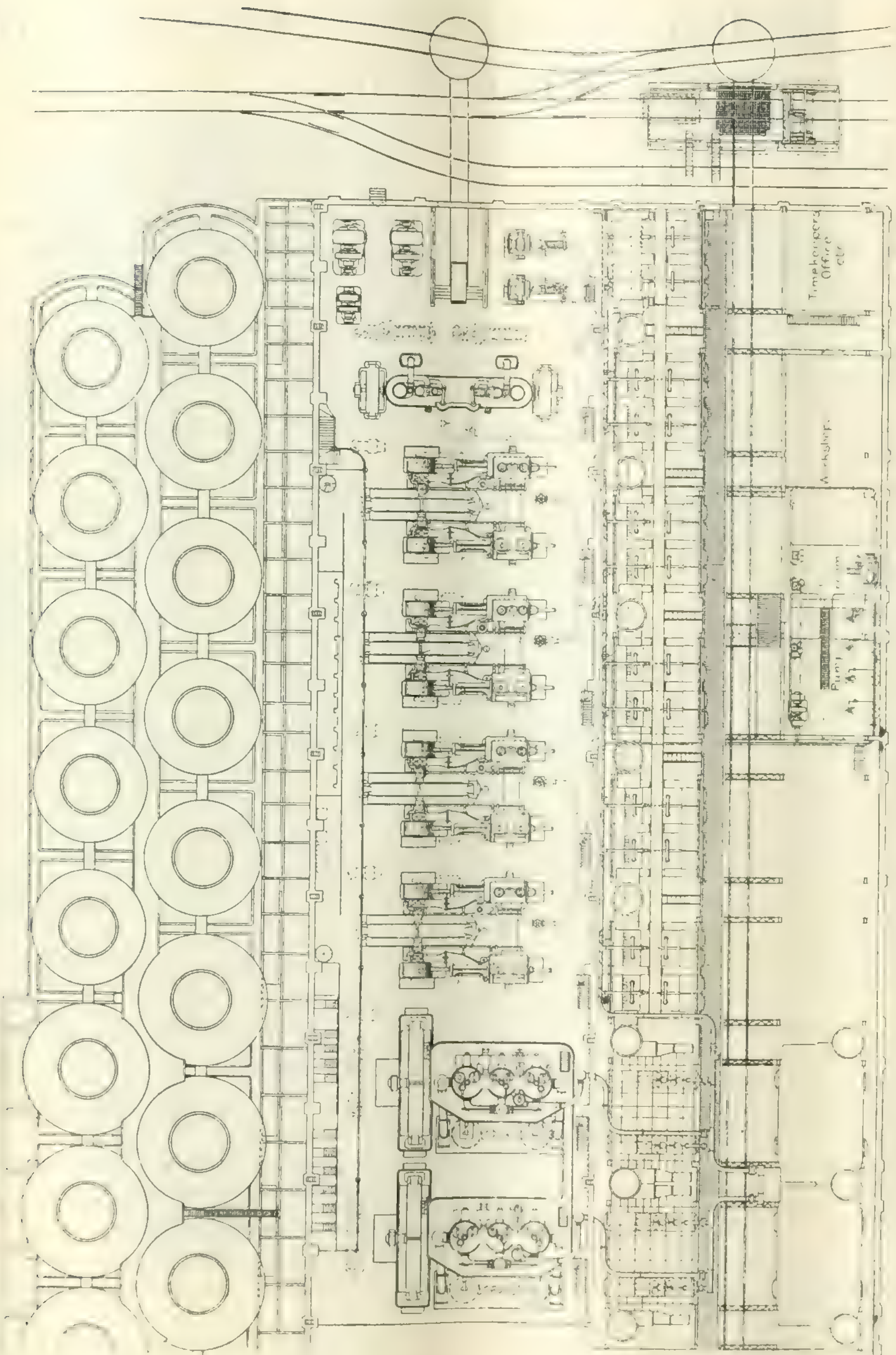


FIG. 1. BOW GENERATING STATION. PLAN.

Last year a pair of these boilers illustrated in Fig. 2 were added; they are erected as one steam unit, and the author believes that they form the largest steam-producing unit in existence.

The type of setting to be adopted was very carefully considered. Owing to the difficulties likely to be experienced, due to the expansion of such large walls in brickwork, it was felt that even if they could be kept upright they would not be airtight; a modification of the wrought-iron casing used for marine boilers was therefore developed, free from the restrictions as to weight which are imposed on marine engineers.

The first design adopted was a composite one of brickwork in the hottest area, extending about 8 ft. up from the ground line. This has been changed in a later design to wrought-iron casing throughout. In the fire zone the fire-bricks are 12 in. thick, while higher up tiles of 6 in. in thickness are used, the brickwork being separated everywhere from the wrought-iron casing by 1 in. of magnesia.

The brickwork between the grates, which is honeycombed and carried up about 6 ft., becomes incandescent during working, and its effect, combined with the ample combustion chamber, ensures a much more perfect combustion than is obtained in the horizontal type of boiler. Coal which might give heavy smoke when burned under the horizontal boilers can, with no more care taken in the hand-firing, be burned without smoke in the "Upright" boilers.

In the case of these boilers the ashpit is divided, so that only a part or the whole of the fire grate can be used as desired, with a similar benefit to that described above. The upright tubes are a great improvement on the horizontal, both as regards external and internal cleanliness. The back sections act as water heaters or economisers with a definite circulation; any scale or sediment is deposited in them, and the front sections kept quite clean.

The pair of "Upright" boilers last erected have been steamed at the rate of 100,000 lb. per hour, and so will easily provide steam under ordinary working conditions for a 4,000-kilowatt generating set. Superheaters were also included with these boilers, as the author has long believed that a water-tube boiler without a superheater is incomplete. Table I gives the leading particulars of the three different sizes of boiler.

CHIMNEYS.

A large amount of ground space is usually taken up in boiler-houses by the foundations of the chimney; the author therefore decided to adopt steel chimneys supported by the steel main frame of the building and placed over the firing space between each pair of boilers. The gases from the adjacent boilers are led into the foot of the chimney by a short breeches piece, each leg of which is fitted with a regulator. It will be noted that this gives the gases an almost direct route from the grate to the top of the chimney, no brick flues are necessary, and no tortuous bends to throttle the draught; in fact, readings taken on many occasions have shown that the draught available over the grate is practically that theoretically due to the temperature and head.

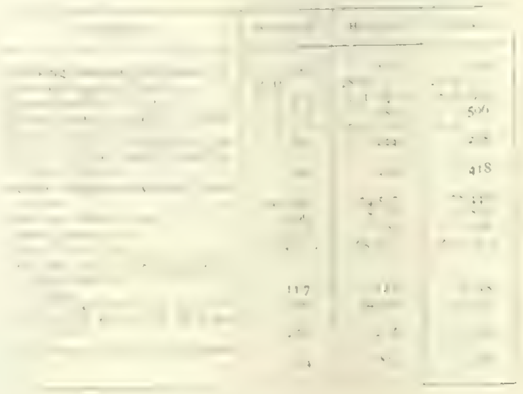


TABLE I.

PARTICULARS OF HORNSBY'S HORIZONTAL AND "UPRIGHT" BOILERS.

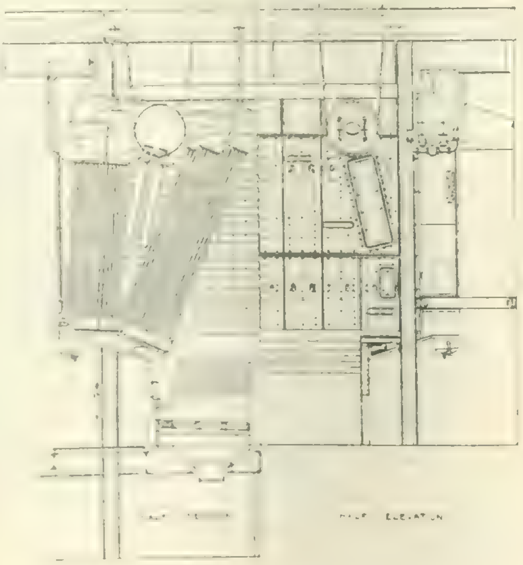


FIG. 2.—HORNSBY'S "UPRIGHT" BOILER.

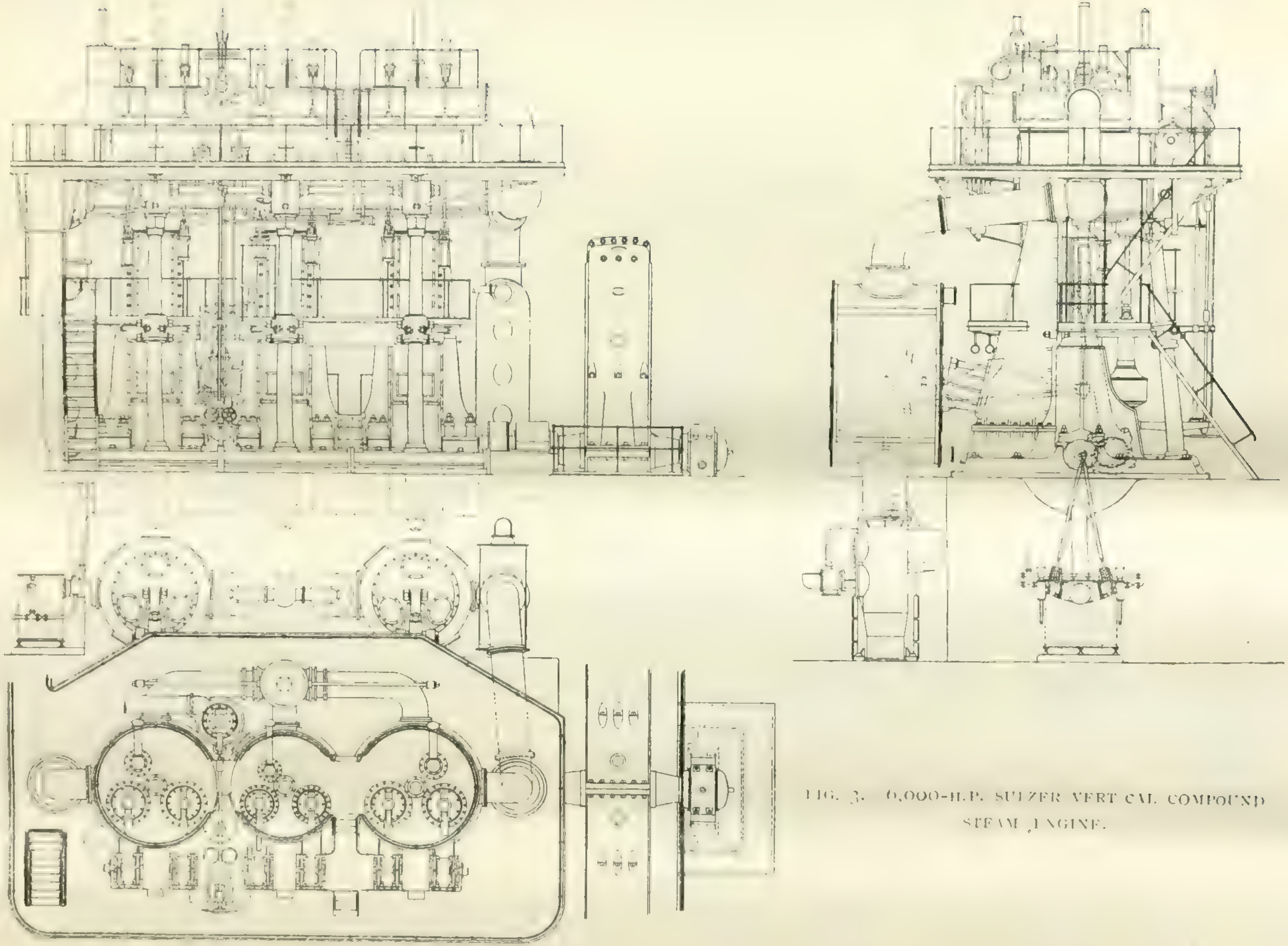


FIG. 3. 6,000-H.P. SULZER VERTICAL COMPOUND STEAM ENGINE.

WATER SUPPLY.

[illegible] water s[illegible] derived from two 13 in. artesian wells on the pr[illegible] [illegible] ft. deep, which each yie[illegible] to [illegible] gallons per hour as required. The method of pumping adopted is the air-lift system, and the water raised is discharged into a large reservoir in the basement below the pump-room. From this reservoir the water is pumped by slow-speed compound steam Woodeson pumps to a tank at the top of the building, from which it runs back by gravity through the water-heaters at the various engines to a tank over the pumps into which their exhaust steam is discharged and to which all the feed-pump suction-pipes are connected. There are also alternative suction-pipes direct into the reservoir in the basement. The feed-pumps are all slow-speed compound steam Woodeson type made by Messrs. Clark Chapman.

GENERATING PLANT.

The first generating plant ordered consisted of two 800 kilowatt sets and two 1,600-kilowatt sets, before referred to, but the demand arose so rapidly that before they were put to work two further 1,600-kilowatt sets were ordered. Last year a 4,000-kilowatt set was added, and a similar set has just been put to work.

The engines driving the 800-kilowatt generators, are three-cylinder triple-expansion, quick revolution enclosed engines of Messrs. Belliss and Morcom's well-known type. They exhaust into jet condensers in the basement, the air and circulating pumps for which are driven by electric motors.

The engines driving the 1,600-kilowatt generators are horizontal cross-compound engines by Messrs. Sulzer Bros., of Winterthur. In details they differ materially from the usual type of slow-speed engine, inasmuch as the connecting rods and cranks are enclosed, and the oil supply is continuous and under pressure.

The valves are of Messrs. Sulzer's latest four-seated pattern. The pistons are provided with tail-rods, and are supported outside the cylinders by special bearings. The cranks are set at 108 deg. instead of the more usual 90 deg., with the low-pressure crank leading. The exhaust steam from the low-pressure cylinder is divided in an oil separator and taken to two jet condensers, one on each side of the engines. These condensers stand on their air-pumps, which are driven from the high and low-pressure crank-pins respectively.

The engines driving the 4,000-kilowatt generators are vertical three-cylinder compound, with the high-pressure cylinder in the centre and a low-pressure on each side of it driving on to cranks which are equally divided. By this arrangement, excessive weight or [illegible] parts is avoided, and an even turning moment is obtained.

Fig. 3. shows the general arrangement of the engine, and it will be noticed that here again the type approximates more closely than is usual in slow-speed sets to an "enclosed" high-speed forced lubricated engine.

The piston-rods, cross-heads, and connecting-rods are entirely enclosed to prevent splashing. The oil is supplied under pressure from a tank above the cylinders, and after running through the engine bed to a filter tank in the basement it is returned to the tank at the top by pumps and used over again.

The valves are of the four-seated type, as used on the horizontal engines. Main and safety governors are both provided, and the latter in addition to automatically closing the main steam valve opens an air valve to break the vacuum. This arrangement can also be operated by a lever from the driver's stand, where all the hand wheels and levers necessary for working the engines are assembled.

A special feature which shows clearly in fig. 3, and has proved thoroughly satisfactory, is the adoption of feed-water heaters on all the engines inserted between the low-pressure cylinder and the jet condenser.

CONDENSING.

Although the Bow Back River suffices to bring freights of coal or machinery to the works, and affords an alternative route to the railway, the water supply was quite insufficient for condensing purposes. As economical working cannot be obtained without condensing, and as the space available was insufficient for cooling ponds, arrangements were made for the necessary cooling of the circulating water in towers.

Jet condensing has been adopted throughout, due to the trouble that the author previously experienced in keeping surface condensers clean enough to ensure a good vacuum with the temperatures available when working in connection with cooling towers. The air-pumps deliver into steel hot wells, and from these hot wells the water is taken by centrifugal pumps, direct-coupled to motors, and delivered into the cooling towers. The vacuum obtained under normal working conditions is between 25 and 26 in.

GENERATORS.

Probably the most striking feature in the generators is the elegance of design combined with solidity and stiffness of construction. In each size of machine the stator is of the box-girder type cast in two or four [illegible] flanges and bolts. The frame is of sufficient stiffness to keep its shape without either radial arms from a bossed centre or stay bolts such as were lately fashioned in some types of machines. Such a construction saves weight, and if it were possible to use it in a rotor it would be excellent, but unfortunately the rotor must have weight to give the necessary steady turning, and the stator must be of such construction and so stiff that it will keep its shape under the strains which arise in working due to magnetic pull and from heating. The stator frames are all bored out in the vertical position in which they will subsequently stand when permanently erected.

The winding is in mica tubes embedded in slots which are nearly closed. Crossings of the wires are as far as possible avoided, and where the coils leave the iron core they are carefully wound over templates and covered over with insulating tape to prevent breakdown between adjacent coils or between coils and the frames. The coils are further protected from accidental contact by a strong perforated cover, which also enhances the appearance of the machine.

If some of the theories which have been advanced in connection with Mr. J. S. Highfield's discovery of nitric acid in high-tension machines are correct, evidences of such acid might reasonably be expected in these machines, and it is interesting to note that even careful dissection and examination has revealed no signs of it. It appears to the author, therefore, that probably the acid is due to impurity of the insulating materials rather than the destruction of pure material by ozone.

NO DIFFICULTY IN PARALLELING MACHINES.

The rotors or magnet wheels which also serve the purpose of fly-wheels, are built up in one or four parts, and are held together by means of bolts and shrunk rings. Such rings are not only used at the hubs, but also at each side of the joints on the rim.

The machines are provided with two sets of spokes or arms. The wrought-iron poles are solid, of circular shape, and bolted on to the wheels in such a manner that they may be dismantled at any time without altering the position of the stator

No difficulty whatever has been experienced in paralleling the 800-kilowatt machines driven by high-speed engines with the larger machines driven by slow-speed engines; any or all of the machines will run in parallel in a way that reflects the greatest credit upon the respective engine and machine builders, and gives confidence to the men who operate them.

Fig. 4. is reduced from working drawings of the 4,000-kilowatt machine.

The drawings of this machine are especially interesting, as they are perhaps the largest machines in this country, and if the present fashion for turbo-generators proves to be justified they will probably remain the largest.

MAIN SWITCHBOARD.

The switchboard is at one side of the engine-room It is arranged in two distinct halves, which, however

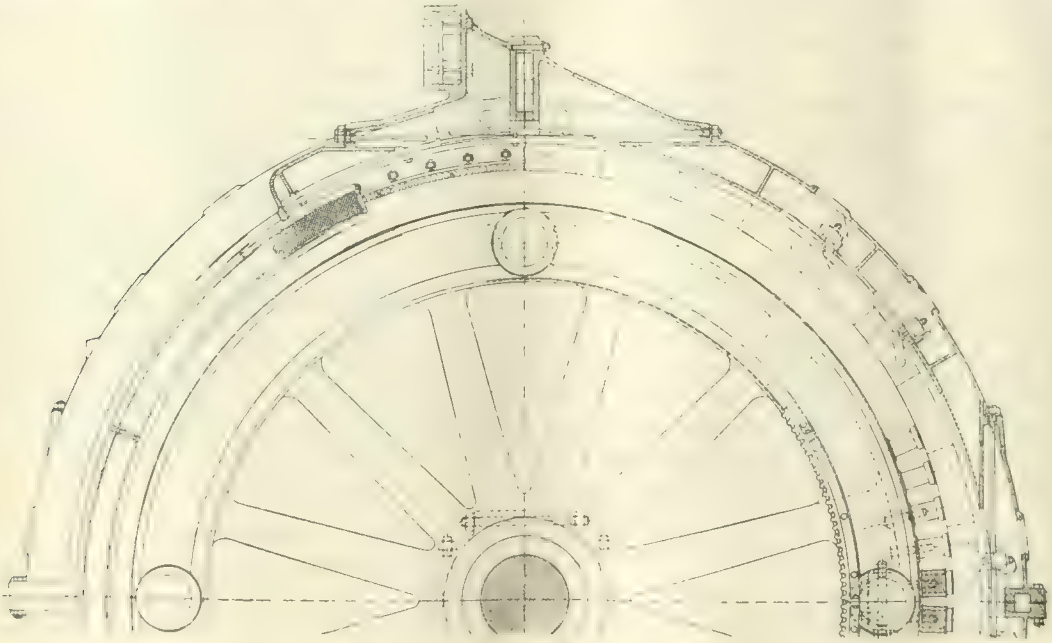


Fig. 4. LAHMEYER'S 4,000-K.W. GENERATOR. SECTIONAL ELEVATION.

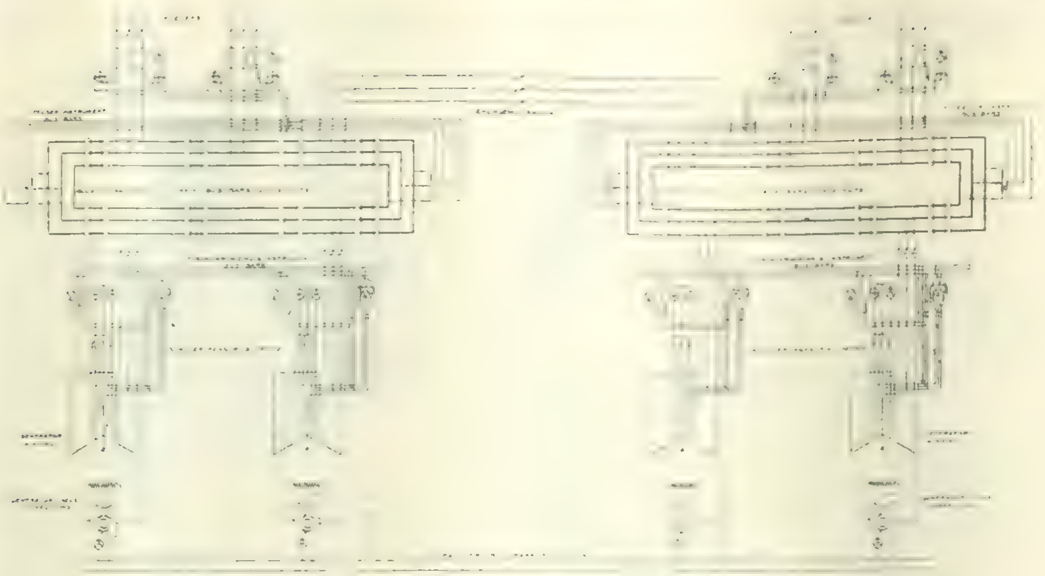


FIG. 5. BOW MAIN SWITCHBOARD—DIAGRAM OF CONNECTIONS.

may be connected by an emergency switch. The generating plant is numbered consecutively, each of the odd numbers being connected to one-half of the switchboard, and the even numbers to the other half. The switchboard is practically a three-decker. The resistances for the fields of the machines stand on the main engine-room floor underneath the principal switchboard gallery. The panels carrying the controlling gear are upon the principal gallery. The high-tension switches are placed on the upper gallery, and are worked positively from the principal gallery by levers.

SWITCHES.

At first, chimney type switches with fuses in series were used, but a little experience with them showed that, although they were very satisfactory for small machines, they were not reliable in connection with large machines and long cables. They have, therefore, been replaced by oil switches, which are also fitted with relays to act as automatic cutouts.

Fig. 5 is a diagram of the main switchboard connections from the generators to the feeders, and shows the Schuler measuring transformer connections together with the two halves of the switchboard and the emergency switch by which they may be connected. It will be noted that the two sets of busbars are kept distinct with their own allotted machines and feeders, and that selector switches are not employed.

TRUNK MAINS.

Ten trunk feeder mains at present leave the generating station; they are all three-core, lead-sheathed paper cables. Six of them go to the City and four go to the West End; means of interconnecting the City cables and the West End cables are provided in the City. The cables are laid on the solid system in steel troughs, which are heavily bonded to comply with the Board of Trade requirements. The cables were ordered when it was believed that the Board of Trade regulations for H.T. applied to E.H.T., and under this rule $\frac{1}{4}$ in. insulation was provided between conductors and between conductors and earth; the latter so that the cables could be worked either with the middle point earthed or unearthed as might be found most desirable. The author does not at all regret the extra paper, as, out of over seventy miles of cable, there has only been one cable fault.

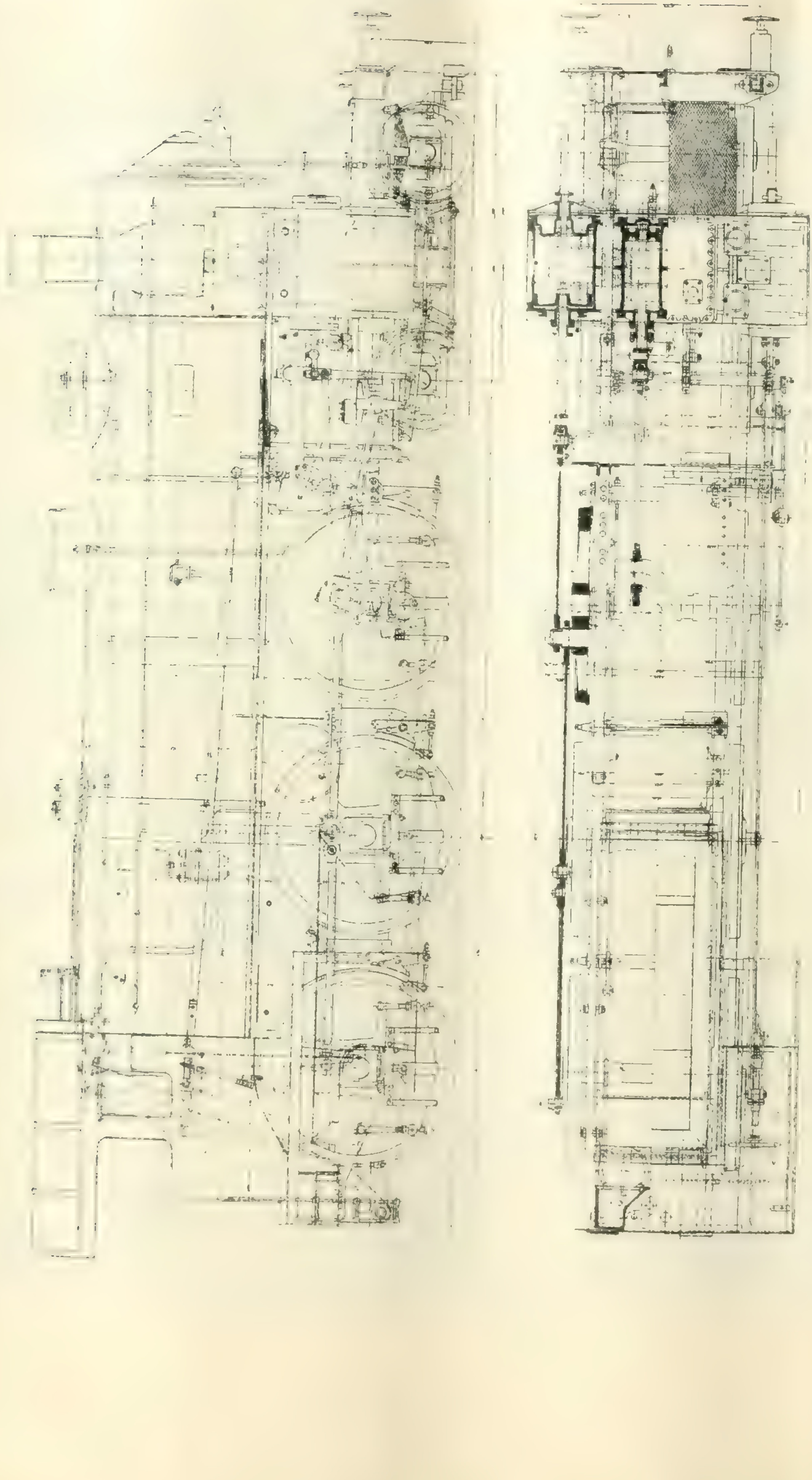
There are four substations in the City, each provided with a motor generator and battery plant. The type of plant used in each is the same.

The substations are arranged for machines and switchboards in the basement; the ground floor may subsequently be used as a battery-room, but it is very convenient for cable stores, trucks, and the other loose plant necessary for the street work of the mains department. The floors over are laid out for batteries.

This building will take motor generator plant of 8,400 kilowatt capacity, and battery plant of 1,600 kilowatt capacity on a four-hour rating.

(To be continued.)

A paper read before the Institution of Electrical Engineers.



LONGITUDINAL SECTION AND PLAN OF SIX-COUPLED EXPRESS LOCOMOTIVE FOR THE BAVARIAN STATE RAILWAYS.

THE NEW TEN-WHEELED EXPRESS LOCOMOTIVES FOR THE BAVARIAN STATE RAILWAYS.

By E. Weiss, State Railway [illegible] Munich

AS the service of express trains is continually being improved and consequently the speeds are increased, and greater loads are hauled, and as the Bavarian trunk lines have unfavourable gradients generally, the locomotives on these lines are now called upon to do work which the older types of the Bavarian State express locomotives are incapable of doing, because their boilers are too small. It is for this reason that the administration of the Bavarian State Railways have designed a series of new and very powerful locomotives, which appear worth describing ; a number of them have been built for the State Railways by the Maffei Works, at Munich. In designing these new locomotives, the following points had to be taken into consideration : It is nceessary to haul fast trains, weight 295 tons, locomotive and tender not included, at an average speed of 62·1 miles per hour on the lines in the level country, and to keep up a speed of 37·3 miles per hour up long gradients of 10 to 11 per mil. As these trains have frequent stops, quick starting and a good acceleration are of special importance.

Apart from these heavy fast trains, the through express trains and limited corridor trains have also to be taken into consideration. These trains weigh on an average 226 tons, and run at an average speed of 74·6 miles per hour on the level and of 43·5 miles per hour up gradients of 10 per mil.

For such work it is necessary to have a locomotive weighing about 69 tons, and a tender of about 49 tons, capable of carrying supplies for runs of at least 124 miles.

Therefore in the case of the heavy fast trains, there has to be a total weight of :

295 + 69 + 49 = 413 tons,

and in that of the lighter trains :

226 + 69 + 49 = 344 tons.

The tractive effort and power required to satisfy these conditions are as follows :

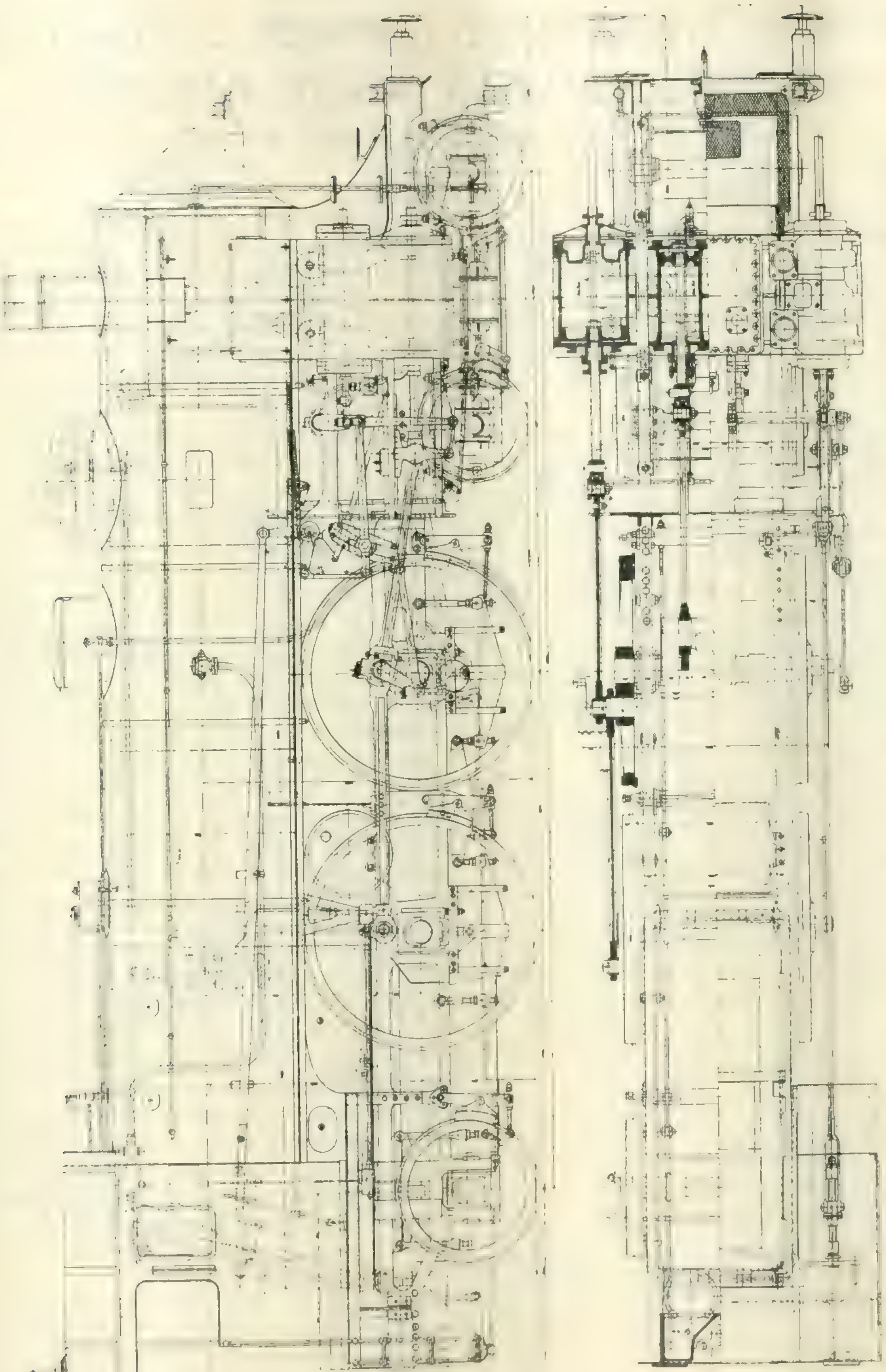
Total weight of train in tons.	Speed in miles per hour.	Gradient, per mile	Tractive effort (in lbs.).	Horse power required
413	37·3	10	13,228	[illegible]
413	62·1	..	7,165	[illegible]
344	43·5	10	11,59[illegible]	[illegible]
344	74·6	..	6,834	[illegible]

As the last column shows, the boilers have to supply approximately the same amount of power in all the different cases, but, in the first place, the tractive effort is so great that in order to obtain the necessary adhesion, it has been necessary to employ six driving wheels. In the third and fourth cases, on the other hand, which refer to the hauling of the lighter trains at a higher rate of speed, four driving wheels, each with a load of eight tons, suffice. Owing to the large amount of power which the locomotive has to develop, the boiler must have a heating surface of about 2,152 square feet, consequently the weight is so great that in order to avoid excessive wheel loads, it has to be carried on ten wheels. For these reasons, it was decided to have six out of the ten wheels coupled in the one case and four wheels coupled in the other.

Reasons of service and maintenance made it advisable to have the different details of the two classes of locomotives as similar as possible. The conditions were favourable in this respect, for, as has been shown above, the same boiler was required in both cases. Moreover, it was possible to use the same cylinders, driving and valve gear, as it was feasible, in the case of the locomotives with four-coupled wheels, to obtain greater speed, with a reduced tractive effort, simply by using larger driving wheels. As regards the other particulars of the system of construction adopted, the following remarks may be made : The system of four-cylinder compounds, adopted several years ago for express locomotives in Bavaria, has been resumed owing to its manifest advantages. But the design hitherto adopted has been modified in accordance with the experience gained up to date.

The old four-cylinder express locomotives, with ten wheels, six coupled, class C[illegible], have four directly driven wheels and two coupled wheels ; the low-pressure cylinders are placed outside, behind the smoke-box, and the high-pressure cylinders are inside ; there are two valve gears inside and two valve gears outside, which are independent of each other.

This arrangement has certain advantages, but it makes it necessary to have very strong cross bracing in between the two low-pressure cylinders, of the box-girder type. This increases the weight of the locomotive to an almost excessive extent, and makes the inside



LONGITUDINAL SECTION AND PLAN OF FOUR-COUPLED EXPRESS LOCOMOTIVE FOR THE BAVARIAN STATE RAILWAYS.

[illegible] which [illegible] partially hidden by the [illegible] gear of the high-pressure cylinders, entirely inaccessible [illegible]. Moreover, it is impossible to [illegible] the riveting of the frame plates and of the [illegible] connecting the cylinders, from working loose, in locomotives of this type, if they often run with high pressure in the cylinders and with late cut-off. Consequently the high-pressure and low-pressure cylinders in the new locomotives have not been placed behind but next to each other, under the smoke-box; thus the cylinders are easily and firmly attached, and it becomes unnecessary to stiffen the frame plates.

Among the numerous other advantages of the arrangement adopted, we may mention the simplification of the valve gear rendered possible, and the elimination of the long pipes connecting the high-pressure and low-pressure cylinders. The low-pressure cylinders are placed outside the frame and the high-pressure cylinders inside. As all the cylinders have piston valves, it is possible to eliminate the numerous parts necessary for balancing flat slide valves; at the same time friction is reduced and also the long and troublesome operation of fitting the valves to their seats. In order to avoid wire-drawing, double ports are provided for both steam and exhaust in the low-pressure cylinders.

All four pistons act on the leading coupled axle. The two cranks of each pair of cylinders are set at 180 deg. The two cylinders on each side (high-pressure and low-pressure) have a common valve gear, of the Heusinger type, placed outside; thus they work at about the same cut-off. The new locomotives have forged bar frames, and consequently the whole mechanism remains freely visible and readily accessible; moreover, this much improves the appearance of the locomotives. Further special advantages of the bar frames are:—

(1) [illegible] small number of rivets and bolts; (2) the accurate adjustment of all surfaces, which makes it possible to keep a stock of horn-wedges and of the other pieces fixed to the frame, and renew them as required; (3) the economy of weight as compared with plate frames: this makes it possible to have a larger and more powerful boiler.

The fixed wheel-base decided on for both types of locomotives is 14 ft. 9$\frac{3}{16}$ in. In the case of the four-coupled wheel type, the trailing pair of coupled wheels of the six coupled wheel type is replaced by a pair of carrying wheels. The four wheel bogies, which have their bolsters placed centrally to their wheel-base, are identical for both types and have a suitable amount of lateral play. The difference in height of the cylinders due to the different diameter of the driving wheels in [illegible] packing blocks placed below the cylinders.

CHIEF DIMENSIONS.

[illegible] of the two locomotives and of their tenders, are as follows:—

LOCOMOTIVE.	Type [illegible]	Type 4-4-[illegible]
High-pressure cylinder, diameter	1 ft. 1¾ in.	[illegible]
Low-pressure cylinder, diameter	1 ft. 10$\frac{7}{16}$ in.	1 ft. [illegible] in.
Length of stroke ..	2 ft. 1$\frac{3}{16}$ in.	2 ft. [illegible] in.
Ratio of volume of high-pressure to low-pressure cylinder	1:2·81	1:2·[illegible]
Driving wheels, diameter	6 ft. 1⅝ in.	[illegible] ft. [illegible] in.
Bogie wheels, diameter ..	3 ft. 1⅜ in.	3 ft. [illegible] in.
Trailing carrying wheels, diameter	—	3 ft. [illegible] in.
Rigid wheel-base of locomotive	14 ft. 9$\frac{3}{16}$ in.	14 ft. [illegible] in.
Wheel-base of bogie ..	7 ft. 2⅝ in.	7 ft. 2⅝ in.
Total wheel-base of locomotive	2[illegible] ft. [illegible]$\frac{7}{16}$ in.	2[illegible] ft. 9$\frac{7}{16}$ in.
Working pressure ..	228 lb. sq. in.	228 lb. sq. in.
Mean inside diameter of boiler	5 ft. 2$\frac{1}{16}$ in.	5 ft. 2[illegible] in.
Thickness of barrel plate .	$\frac{11}{16}$ in.	$\frac{11}{16}$ in
Number of smoke tubes	283	283
Diameter of smoke tubes external	2$\frac{3}{64}$ in.	2[illegible] in
Diameter of smoke tubes, internal	1⅞ in.	1[illegible] in
Length of smoke tubes ..	14 ft. 11$\frac{3}{16}$ in	14 ft. 11$\frac{3}{16}$ in.
Heating surface inside firebox	156 sq. ft.	156 sq. ft.
Heating surface inside smoke tubes	2,056 sq. ft.	2,056 sq. ft.
Heating-surface total (H)	2,212 sq. ft.	2,212 sq. ft.
Heating surface, total external	2,411 sq. ft	2,411 sq. ft.
Grate area (R)	35·31 sq. ft.	35·31 sq. ft.
Ratio H : R	[illegible]	62·7
Height of centre line of boiler above rail level ..	9 ft. 2¼ in.	9 ft. 4$\frac{13}{16}$ in.
Total length of locomotive	38 ft. 7$\frac{13}{16}$ in.	38 ft. 7$\frac{13}{16}$ in
Total width of locomotive	10 ft. 2 in.	10 ft. 2 in.
Total height of locomotive with chimney ..	14 ft. 9⅞ in.	15 ft.
Total height of locomotive without chimney	[illegible] ft. [illegible] in.	13 ft. 11⅛ in.
Weight of locomotive, [illegible]	[illegible] tons	[illegible] tons
Weight of locomotive in working order (G) ..	67·5 tons	66·9 tons
Adhesive weight of locomotive	44·[illegible] tons	31.5 tons
Maximum load per pair of [illegible]	[illegible] tons	15.7 tons
Tractive effort total (Z)	15,697 lb.	14[illegible] lb.
Tractive effort per square foot of internal heating surface (Z : H)	7.09 lb.	6.62 lb
Tractive effort per ton of weight in working order (Z : G)	2[illegible]3 lb	22[illegible] lb.

	Type 4-6-0	Type 4-4-2
Tractive effort per ton of adhesive weight ($Z:G_1$)	340 lb.	466 lb.
Tender.		
Number of pairs of wheels	4	4
Diameter of wheels ..	3 ft. $3\frac{9}{16}$ in.	3 ft. $3\frac{9}{16}$ in.;
Wheel-base of bogies ..	5 ft. $8\frac{7}{8}$ in.	5 ft. $8\frac{7}{8}$ in.
Distance between bogie centres ..	10 ft. $11\frac{7}{8}$ in.	10 ft. $11\frac{7}{8}$ in.
Total wheel-base of tender	16 ft. $8\frac{3}{4}$ in.	16 ft. $8\frac{3}{4}$ in.
Total length of tender ..	24 ft. $5\frac{3}{16}$ in.	24 ft. $5\frac{3}{16}$ in.
Total width of tender ..	10 ft. $2\frac{13}{16}$ in.	10 ft. $2\frac{13}{16}$ in.
Water	4,840 gall.	4,840 gall.
Fuel ..	5·9 tons	5·9 tons.
Weight of tender, empty.	21·7 tons	21·7 tons
Weight of tender in working order ..	49·2 tons	49·2 tons
Maximum load per pair of wheels	12·4 tons	12·4 tons
Total wheel-base of locomotive and tender ..	54 ft. 10 in.	54 ft. 10 in.
Total length of locomotive and tender	63 ft. 1 in.	63 ft. 1 in.

DETAILS OF CONSTRUCTION—BOILER.

The fire-box of the six-coupled locomotive necessarily had to be placed between the rearmost coupled wheels, and its width was consequently limited by the space available between them. In the case of the four-coupled wheel locomotive, the same fire-box was adopted, as otherwise it would have been necessary to increase the length and the wheel base of the locomotive materially. The outer shell of the fire-box is of mild steel, the fire-box proper is of copper.

The foundation ring is supported direct on the bar frame by means of forged projections and bronze packing pieces, consequently there are no bolts or stays which have to help to carry the boiler. Vertical movement is prevented by hook ties, which take into corresponding slots in the projections.

The outer shell of the fire-box, which is of the usual type with cylindrical dome, consists, like the fire-box proper, of a single pressed plate. The back of the fire-box slopes towards the front. The walls of the fire-box and the shell are held together, as usual, by copper stays at the sides and by iron stays at the top.

The back plate of the mild steel shell of the fire-box is stiffened by means of longitudinal forged ties, instead of plate, so that the bubbles of steam may pass up freely over the crown.

The barrel of the boiler has an average internal diameter of 5 ft. $2\frac{5}{16}$ in., and consists of three rings; the dome is on the front one. The longitudinal seams are butt jointed with cover plates treble riveted, and have a factor of safety of 4·2 at the weakest section, the plate being $\frac{11}{16}$ in. thick. The transverse seams of the fire box and of the barrel have a double row of rivets, the front tube plate and the smoke box have a single row of rivets.

Below the fire-box is an ashpan with several divisions with two doors or dampers which can be operated from the cab; it has a slide door at the bottom to facilitate disposal of the clinkers.

The conical cast-iron chimney has been fitted with a removable top ring so as to make it possible to reduce the total height of the locomotive,

The grate is horizontal, and consists of three rows of ordinary bars of hard cast iron.

The boilers are provided with the following fittings.—

A water gauge, with cocks, three gauge cocks, a pressure gauge, a steam whistle, two steam pipes for the injectors, one steam pipe for the Westinghouse pump, one steam pipe for the steam blower, one steam pipe for steam heating, one steam pipe for the cylinder lubricators, two feed check valves, one mud valve, a double safety valve with long travel, two Friedmann No. 10 lifting injectors, fitted to the boiler inside the cab, a regulator consisting of a double-seated valve with handle working on a toothed sector, and so arranged as to be capable of being locked in any position.

Cocks have been avoided as much as possible in the fittings of the boiler.

The boiler and smoke-box are covered externally with sheet-iron lagging; the boilers of several of the eight-coupled wheel locomotives have been covered, as an experiment, with prepared asbestos.

FRAME.

The bar-frame is made of double-welded, fagotted iron; it is forged so that the horn plates are made of one piece and that the welds are in the straight parts subjected to the least stresses. After it has been welded together, each side of the frame is heated up again in a reverberatory furnace and annealed, in order to eliminate any stresses resulting from welding.

The front part of each side of the frame, which bears the cylinders, consists of one piece, firmly joined, between the cylinder and the driving axle, to the back part. The two sides are joined in front by the high-pressure cylinders, and by a certain number of cross-beams to which the boiler is secured, and at the back by the draw-bar buffer beam, and by two bearers of steel casting below the fire-box; these bearers serve as lateral guides for the latter.

At the front end of the frame is the buffer beam, which is of channel section. As the part of the side frames in front of the cylinders only has a small moment of [illegible] the boiler barrel is stiffened from the smoke-box in the six-coupled wheel type by two stay bars, and in the four-coupled wheel type by plates fixed vertically. The method of securing the fire-box to the frame is such that there is no risk of straining it [illegible] locomotive is lifted without the [illegible] stays.

The [illegible] bogie has a plate frame and [illegible] about its centre; sufficient lateral play is provided to enable the locomotive to run round curves of nine-chains radius without difficulty. The return of the bogie to its normal position is ensured by a double check spring of the plate spring variety. The locomotive is supported on the front bogie through a spherical bearing.

AXLE-BOXES. BEARINGS, AND SPRINGS.

The axle-boxes of the driving and coupled wheels have springs placed below them; the bearings are of bronze lined with white metal. The cast-iron horn slides, which are of channel section, are bolted up to the frame. Their vertical medial plane coincides with that of the frame. The horn wedges are of wrought iron. On each side a compensating beam is provided for the driving axle and the coupled axle, so as to equalise the load on the springs.

CYLINDERS.

The high-pressure cylinders, which are placed inside the frame are cast in one piece, together with the piston valves and the boiler seat; they are secured to the frame by means of bolts and keys. The low-pressure cylinders are outside and bolted to the high-pressure cylinders. This arrangement has the advantage that if the low-pressure cylinders which are more exposed, are damaged, they alone have to be replaced, whereas, if the high-pressure and low-pressure cylinders are cast in one piece, then in case of damage both have to be replaced.

As the cranks are set at 180 deg., the high-pressure cylinder has the steam ports at the middle of the valve, and the low-pressure cylinder has the steam ports at end of the valve. The ports of the piston valves are cut in liners of tough hard cast iron forced into the casting.

The cylinders have relief valves on all the covers. Air-inlet valves are fitted to the high-pressure valve chest and the intermediate receiver; these are connected together by a pipe with a valve operated automatically by the reversing gear, so that when the cut-off of the high-pressure cylinder is at 70 per cent. of the stroke or later, high-pressure steam enters the low-pressure cylinder.

ENGINE.

The pistons are steel castings, with an ordinary rod in the high-pressure cylinders and with rod and tail rod in the low-pressure cylinders. The cast-iron piston rings are sprung into grooves in the piston. The crossheads, the slippers of which are lined with white metal, run between two slide bars of hard Siemens-Martin steel. The connecting rods have closed adjustable ends, whereas the coupling rods have closed ends, with bronze non-adjustable bushes. The crank pins of the coupling rods and connecting rods are made of Siemens-Martin steel; the wearing surfaces are case-hardened. The cranked driving axle is of nickel steel; the coupled axles and the carrying axles are of Siemens-Martin steel. The wheel centres are steel castings; balancing is only provided for the rotating masses.

The Heusinger valve gear is placed outside and has a rocking slotted link with block. The movement of the reversing gear is transmitted to a shaft placed in front of the cylinders, the levers on it are connected with the piston valve rods by a system of links. The reversing gear is operated by means of a screw and hand wheel.

BRAKE, ETC.

All the wheels of the locomotive can be braked. The driving and coupled wheels, and in the case of the eight-coupled wheel locomotive also the trailing carrying wheels, are braked by a Westinghouse brake placed behind the fire-box. The bogie wheel brake blocks are operated by two double cylinders placed laterally between the wheels, the piston rods of these cylinders acting through links on the brake block hangers The rodding is designed so as to equalise pressures.

These locomotives are also fitted with Hausshälter speed gauges, with sanding apparatus, with a reducing valve for the steam heating, with Limon lubricators for the cylinders, with lights and with drawing and buffing gear of the type in use on the Bavarian State Railways.

TENDERS.

The eight-wheel tenders of the two types of locomotives are identical and are of the usual pattern; they differ from those used with the old express locomotives, class *Cv*, of the Bavarian State Railways, only in the capacity of the water-tanks which hold 4,840 gallons of water, instead of 4,620 gallons.

At present there are ten locomotives of the four-coupled wheel type and thirteen of the six-coupled wheel type in use; fifteen more of the latter are now being built. Up to the present, these locomotives have realised everything that was expected of them.

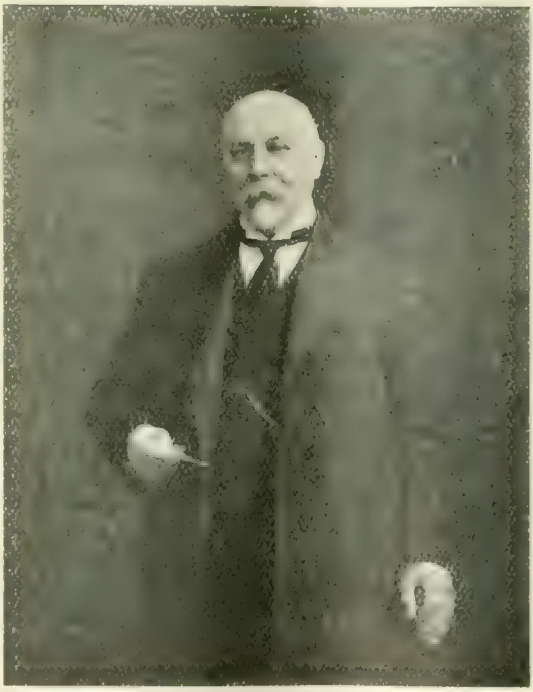
[illegible] the International Railway Congress.

OUR WEEKLY BIOGRAPHY.

SIR JAMES WILLIAMSON, C.B., Director of H.M. Dockyards.

SIR JAMES WILLIAMSON, who will shortly retire from the post of Director of His Majesty's Dockyards, after holding the position for nearly fifteen years, is the eldest son of the late James Rea Williamson, of Edinburgh. Born in 1839, he was educated at the Esplanade House Academy, the Portsmouth Grammar School, and afterwards proceeded to the Royal Dockyard to be trained as a naval architect and engineer. He passed out of the Dockyard School with much credit, and, by competitive examination, was made a draughtsman. At the age of twenty-four the Admiralty selected him to assist in superintending the building of H.M. ironclad ship *Northumberland*.

About this time the committee of Lloyd's Register of British and Foreign Shipping offered him a post on the technical staff of that important association. He accepted their offer and remained with them for eighteen years, during which time he was stationed in turn at all the principal shipbuilding and engineering centres in the country. During the last eight years with Lloyd's he was their principal surveyor in the Sunderland district. The exceptional tact and judgment he displayed in carrying out his official duties in this position won for him the general approval of the public as well as that of Lloyd's Committee of Management. In 1882 Sir James accepted an appointment as general manager of the business of Messrs. Barclay, Curle and Co., one of the oldest shipbuilding and engineering firms on the Clyde. Eighteen months later he became a partner. The extent of his work while with this firm will be realised when it is stated that in ten years he designed and built seventy-eight vessels, comprising liners, sailing ships, fast river steamers, and yachts, for some of the leading companies at home and abroad.



Photo, Elliott and Fry.

SIR JAMES WILLIAMSON, C.B.,
DIRECTOR OF H.M. DOCKYARDS.

With such a large experience and successful record it was not surprising that, in seeking for a successor to Professor Elgar, Lord George Hamilton, the then First Lord of the Admiralty, should have offered the directorship of H.M. Dockyards to Mr. Williamson.

It will be remembered that this office was created in 1886 to obtain the services of men of proved business capacity for the management of the Royal Dockyards. It was hoped that a change from a purely service trained official to one who had a good commercial experience would prove decidedly advantageous to the public service. It is now generally admitted that the exertions of Dr. Elgar from 1886 to 1891, and of Sir James Williamson from 1891, to the present time, have in every way fulfilled the highest expectations. Some idea of the increasing and onerous responsibilities of the Director's office will be gained by stating that the numbers of employees in the Home Dockyards have increased from 18,000 in 1891 to 35,000 in 1905, and the wages paid have correspondingly increased from £1,000,000 to £2,750,000 per annum.

Sir James joined the service at a time when contract-built ships were being delivered for completion in the Royal Dockyards. His responsibilities were considerably increased by the gigantic projects carried out during his tenure of office under the Naval Works Loan Bills; these included the installation of electric light and power in all the Admiralty's naval establishments.

His public utterances on more than one occasion record how much he deprecated the inflation of the naval establishments to their present almost unmanageable dimensions, foreseeing, as he did, that the reaction, now upon us, was inevitable. One of the great causes of this inflation was the large increase in the numbers of men required to complete in the dockyards the "Naval Defence Act" ships built by contract. Sir James's contention was that the contractors should finish their own ships. In this he was strenuously opposed by those who should have supported him, but two years since he had the satisfaction of seeing his proposals carried out, resulting in a great saving of time and cost, and advantage to the contractors themselves.

As a mark of appreciation of his work in connection with the Royal Dockyards, he was knighted by the late Queen in 1900, and His Majesty the King in 1902 conferred upon him a Companionship of the Bath.

THE AMERICAN STEEL CAR INDUSTRY.

An American contemporary states that steel car plants of the United States are now making close to 225 steel cars every working day, and are making improvements which will, some time early next year bring their daily output up to about 275 cars daily. They are sold up for about a year ahead, even having regard to the prospective increase in capacity. An independent concern, heretofore making wooden cars only, is about to build a steel car plant which will have an output of 25 cars or more daily, so that the total prospective output of the country is about 300 cars daily, this figure having regard to actual output on the current run of business, and not to such outputs as can be made occasionally on a special run. This speaks very well indeed for an industry which recently, when total capacity was less than it is now, ran for a period of more than a year at less than 25 per cent. capacity.

The industry is naturally an enormous consumer of steel. While the original type of steel car was one weighing about 40,000 lb., and having a capacity of 100,000 lb., smaller cars are being built for certain purposes, particularly for use in the Lake Superior ore region, and the average weight of all cars turned out is less than 40,000 lb. It can be estimated roughly that in 1906 the steel car industry will consume considerably more than 1,000,000 tons of rolled and forged steel products, including plates, shapes, merchant bars, and axles, while adding to the pig iron used for the production of this material, the pig-iron used in wheels and malleable and steel castings there is indicated the equivalent of well over 1,500,000 tons of pig iron to go into steel cars.

There is plenty of work ahead for the steel car industry. There are now about 1,800,000 freight cars in use by the standard railroads, of which less than one-eighth are steel or steel underframed. The wooden cars are being replaced with steel cars, and additions are being made to the total number of cars. Besides this, there is a new field just being opened up in the line of all-steel passenger, mail, baggage and express cars.

THE WEST OF SCOTLAND IRON AND STEEL INSTITUTE.

PRESIDENTIAL ADDRESS.

FROM the West of Scotland Iron and Steel Institute we have received the Presidential address of Mr. A. Lamberton, reviewing in an interesting manner some recent developments in steam, gas, and electrical engineering, and improvements in the manufacture of steel. The following is an abstract:—

TURBINE v. RECIPROCATING ENGINE.

Statement that the turbine appears to have sealed the fate of the reciprocating engine should perhaps be qualified somewhat, though this refers probably to the vast majority of steam engines. It would seem probable, however, that there may always be a duty called for that the steam turbine may not be able to fulfil. Perhaps the best example that I could give of this would be to refer to the huge rolling mills which are used in our steel works for rolling heavy slabs and blooms. For such work it is imperative that the heavy mass to be rolled should enter the rolls very slowly, so that the initial shock be reduced as far as possible. As soon as it is seized by the rolls, an enormous torque, or turning effort, is called for to pull it through; and it is just this class of duty that the steam turbine seems unable to accomplish. It is probable, therefore, that heavy reversing engines of the type so well known in our steel works, will be confined to this class of work, at least for some time.

It is most interesting, in this connection, to note the latest development in steam-turbine engines. I refer to the low-pressure turbine generator designed by Professor Rateau, of Paris, for the purpose of utilising the exhaust steam from reciprocating engines and returning the work contained in the rejected heat in the form of electrical power. Of all the attempts that I have known in the way of rendering such engines, which are notoriously wasteful, more economical in their working, this system designed by Professor Rateau seems to be much in advance of anything yet introduced, and holds out a most fruitful source of economy to the iron and steel industry of this country.

With the improvement in the quality of steel tubes and in the discovery of lubricants which are not decomposed at temperatures of 700 deg. F., the way has been opened for the successful superheating of steam; and there has followed a distinct economy wherever this system has been successfully introduced. It has, however, to be carefully worked, so that the control of the superheating may be as perfect as possible, but there is no doubt that this subject is now understood in a way that it has never been before, and it may fairly be taken to have established itself as a necessary part in all modern economical steam installations.

IMPROVEMENTS IN GAS-POWER PLANTS.

The development which has taken place in this branch of engineering during the last few years has been extremely rapid, more particularly on the Continent; but even in Great Britain there are now at work a sufficient number of gas-power plants to justify the claim made that in this form of power great developments will shortly follow. It is beyond question that where fuel has to be burned for the supply of motive power and heating purposes, the system of first gasifying the coal and recovering therefrom the by-products, and thereafter utilising this gas in gas engines and in Siemens' furnaces and soaking-pits, ensures very distinct economy. The progress that "gas" plants have already made in this and other countries is the best proof of this.

With regard to large gas engines, a number of these can now be seen at work, and apparently giving satisfaction. If we could have confidence that, in spite of their obvious intricacy of parts and the difficulties which the high cylinder temperatures inevitably entail, these engines could be made reliable, then possibly more progress would be made in this direction. So far as I have been able to discover, the records of most of the large gas engines in this country have not been such as to justify their being able to claim anything like the same reliability in operation and freedom from stoppages as can be claimed for the steam engine. It is, perhaps, unfair at the beginning of the history of these engines, to expect that they could be as reliable as a steam engine which has been developed and improved for a hundred years; but, looking back as we have done, on the history of the steam engine the question arises if gas-engine designers are not also on the wrong lines in devoting their energies so exclusively to the reciprocating engine.

If a successful design of gas turbine were brought out nine-tenths of the whole difficulties possessed by present gas-engine designs would disappear. That such a gas-driven turbine will be made a success I have no doubt whatever; and it may come much sooner than we expect, and with it will disappear all the intricate water-cooled pistons, piston rods, elaborate valve gears and complicated electric time-firing devices. Should this be so, I have no hesitation in saying that the future of iron and steel making will embrace in its equipment gas-turbine blowing engines, driven by blast-furnace gas Siemens' open-hearth acid and basic furnaces, also fired with blast-furnace gas—the molten iron being run from the blast furnace into the mixer, and from the mixer into the open-hearth furnace, and finally from the furnace into the ingot mould, all by gravity, without any handling whatever. There can be no doubt that the comparatively slow progress which has been made in this country in the introduction of gas-driven blowing engines and gas-driven rolling-mill engines has been almost wholly due to the fear that the intricacy and delicacy of these engines would render them unfit for the rough and constant work required in these operations. When arrangements can be made which enable a gas motive-power installation to be in the form of duplicate engines, the difficulties, of course, are reduced; but this plan is very costly, and in blowing engines particularly, the capacity is relatively so small compared to the cost of the engine, that, taking all into consideration the advantages are not absolutely convincing. The one thing above all others required in a blowing engine is that it shall be absolutely reliable and at all times ready for duty; and although gas-driven blowing engines can show a decided thermal economy over the steam engine, any irregularity in their performance, causing stoppages, could very easily far outweigh their economy. Doubtless these are the considerations which have weighed with ironmasters in this country, and which perhaps account for the small progress made in this direction.

Before leaving the subject of gas-power plants, I should like to refer to an installation of sheet-rolling mills, which, through the courtesy of Mr. William Beardmore, I was privileged to see lately at Parkhead Works. This engine was of the Oechelhauser type and was driving a 2-high sheet mill with roughing and finishing rolls. The performance of this engine seemed to be quite satisfactory; and I understand a very distinct saving has been effected in fuel. There is also an installation of gas engine driven mills at Messrs. Monks, Hall and Co.'s Works in Warrington, where a 14-in. bar mill, with separate roughing rolls, is driven by a gas engine; and I understand the results [illegible] satisfactory, so that I must speak with caution in regard to these matters. It resolves itself into this, that if absolute reliability in running and freedom from stoppages could be guaranteed, then the gas engine, by reason of its higher thermal efficiency, is bound to prevail. But I have a strong conviction that the final solution is to be found in the simplicity of the gas turbine, and not in the complicated reciprocating engine of to-day, which, like the reciprocating steam engine, may soon pass away.

The last notable development in gas engineering of late years has been that in connection with smaller power plants, and which are known as suction-producer plants. The economy derived from this system of motive power is extraordinarily good; and undoubtedly there is a very large future for this invention. It is eminently suitable for moderate power plants; and the gas producer plant has a simplicity which is quite ideal. The comparative efficiency of this system, as against the best steam engines, shows an efficiency of at least two to one and the cost is less than an engine and boiler and chimney would be; so that the future of this system is assured.

Another most important form of power which has recently been brought to great perfection is that of oil fuel; and several very successful engines are on the market—notably the "Hornsby-Ackroyd," "Priestman," and "Crossley." But pre-eminently in the front of all these is the "Diesel" engine, which has now passed from the experimental stage into a most reliable and highly economical machine. The number of engines of this type now at work on the Continent is very large, and they are being freely introduced into this country also; and it is worthy of note that the Admiralty have adopted it for marine work on their pinnaces and similar light craft. The efficiency of this engine in actual work is much better than the steam engine; and it is practically the only engine that will work successfully with the commonest kind of crude oils without the valves giving trouble by clogging.

DEVELOPMENTS IN ELECTRICAL ENGINEERING.

The advance in electrical engineering at the present day has been great and steady; and there are fields yet untouched in which this form of energy is bound to outstrip all others. With such huge installations as are to be seen in all our great cities for the lighting [illegible] the [illegible] power to street cars, it would seem almost like old-fogeyism if one were to sound anything in the nature of a note of warning in regard to the adoption of this form of power. We are all united in our admiration of the beautiful form of energy which has already done so much to transform and improve the conditions of travel in our cities; but it is no disparagement to the system to say that its success, either in great or small installations, depends upon the nature of the work to which it is put and the methods of carrying out the installation. During the last few years there has been something approaching a furore created by electric driving, and any works which were still being driven by steam engines were apt to be criticised as hopelessly out of date. The result of this was that many very unsuitable installations of electricity have been erected, and the results have frequently been disappointing. The short experience that engineers have had of this form of driving has been sufficient to show that in many of the early installations the motors used were very much too light and underpowered, and consequently caused trouble. To ensure success it is necessary to have dynamos and motors with a large margin of power in excess of requirements, but with this, and good workmanship, very good results may safely be looked for. In this connection, it is interesting to read what the chief engineer of the Manchester Steam Users' Association, Mr. Michael Longridge, says in his report for the year 1904, referring to their Electrical Insurance Department. He points out that the increase in their business in this department amounted to 20 per cent. last year, whilst the breakdown in electrical machinery rose [illegible] cent. in the same time. Taking all the electrical plant which this company has insured (and which we may reasonably assume is of very fair quality), or they would not have accepted the risk), it shows that 10 per cent. of all the motors that they have insured break down annually. This fact in selected risks is a sufficient justification for commenting upon the unwise rushing into electric driving; and I do so from the conviction that much of the trouble could have been avoided by more careful consideration and more perfect workmanship.

A very interesting development in electrical engineering is that introduced by the Chloride Batteries Company, of London, and which has for its object the steadying of the load in installations where the work is very variable in amount. Take an instance in which the average horse-power is 1,000, and that by reason of the intermittent character of the load this may fall to 500 h.p., or may rise to 1,500 when all the load is on. [illegible] this the generating machinery would, in ordinary circumstances, require to be capable of meeting 1,500 h.p., and of a size sufficient for this. In the Chloride Batteries invention the size of the plant is fixed, say, at 1,000 h.p., and during the fluctuations to 500 h.p., the excess power of the generator is stored in the batteries, and when the load rises above the normal to, say, 1,500 h.p., these batteries give out the accumulated power which has been delivered to them, and so the peak of the load is taken by the generator plus the batteries, whilst in the low power the generator restores the excess energy to the battery for future use. The advantage of this is that a smaller plant does the work, with a reduced initial cost and reduced cost in running; and successful results have been obtained by this combined system of generator and battery. It is somewhat on the same lines as the "Ilgner" system, in which a generator and a motor, with a very heavy flywheel, are so coupled up that when the load is less than the power of the generator the excess power is stored in the flywheel, and when the load is in excess of the capacity of the generator the flywheel effect is given back through the motor to the generator. That is to say, the generator and the motor exchange functions, the motor becoming the generator and the generator becoming the motor, so that any excess power given to the flywheel is returned again to the generator when required. An installation of this kind is being put down at one of the oilworks in Scotland, and the result will be watched with considerable interest.

IMPROVEMENTS IN THE MANUFACTURE OF STEEL.

Not the least interesting of the many improvements that have been introduced in these later days are those affecting the manufacture of steel. The Bessemer process, which has held its own for such a length of time, and which, in a way, can be said to have made the steel industry, has now met such a formidable rival in the open-hearth process, that the probabilities are, with the further developments which are taking place in the open-hearth system of steel making, the Bessemer process will fall more and more into disuse. The open-hearth process is to-day the only one by which plates for ships and boilers and the highest class of structural and sectional steel, are produced. Bessemer steel is practically only used for rails, tinplate bars, and such like. In Scotland, very excellent results have lately been obtained from open-hearth basic steel; and although there has been strong prejudice against this basic process, it is gratifying to know that excellent plates are now being produced from open-hearth basic furnaces, the [illegible] and test [illegible] most favourable comparison with the best acid steel, and these plates are now accepted by Lloyd's as quite satisfactory. [illegible] hoped [illegible] this stage has been arrived at, manufacturers will use every care that basic steel plates should not again be condemned through any fault or carelessness in manufacture. There is no reason why the best of steel plates and other structural material should not be regularly obtained from open-hearth basic furnaces; and there is no doubt that by this process substantial economy is obtained.

TOOL STEEL.

The improvements which have taken place lately in the manufacture of tool steel have been extremely striking. Until some five or six years ago Mushet's self-hardening steel stood easily first as the best tool steel for hard work and high speed. During these few years, however, a complete change has come over the manufacture of this material, and alloys have been invented containing chromium, tungsten, and vanadium, from which most astonishing results have been obtained. A few years ago the cutting speeds at which planing and turning tools could be driven was about 20 ft. per minute. By the use of the new steels this has gone up as high at 60 ft. per minute, and even more astonishing results have been obtained in regard to drilling. It is now possible to drill a hole in cast-iron, 18 in. diameter by 12 in. deep, in one minute. This is ten times the speed that could have been attained a few years ago. The results accruing from these improvements will be far-reaching, as they will greatly cheapen the cost of machining forgings and castings, and proportionately reduce the cost of the structures into which these enter. And so it is that by such improvements, which in themselves may appear small, great and far-reaching results are brought about.

In connection with recent improvements in steel, perhaps no name stands out more prominently than that of the President of the Iron and Steel Institute, Mr R. A. Hadfield. He has been a most devoted student of this subject, and has probably carried out as much original research work in this direction as anyone. His success in the production of manganese steel, where great wearing properties are required, has been quite remarkable; and it is evident to those who have perused his presidential address, delivered in London last May, that he has not yet reached the end of his researches, but may any day surprise the steel world with fresh discoveries of the first importance.

We often hear in these days of the difficulty of getting on in the world without the advantages of fortune to aid us. The real truth is, however, that the world is not waiting for money, but for brains, and is prepared to pay, and pay handsomely, anyone, be he rich or poor, who can show possession of superior mental gifts combined with an earnest desire to work.

The manual work of the world is of enormous importance, and that our workers should be healthy, happy and contented in their work, is one of the ideals which a nation ought never to relinquish; but important as this undoubtedly is, the real measure of a nation's progressiveness is to be found more in the amount of brain that is put into the work of everyday life. If we are to keep our position in the race for supremacy, our workmen must be strong, healthy, and contented; but over and above all this, we must as a nation endeavour to cultivate and develop in the industries in which we are engaged, the spirit of thoughtfulness and research, so that not only from a few outstanding men, but from amongst the rank and file, there may come suggestions, improvements, and inventions that will ensure our keeping in the front of all commercial and manufacturing enterprise.

AUTOMATIC STOKERS AT THE SMOKE ABATEMENT EXHIBITION.

One of the most interesting exhibits shown at the Royal Agricultural Society's Hall, Vincent-square, Westminster, by the Royal Sanitary Institute, in conjunction with the Smoke Abatement Society, is that of Messrs. Ed. Bennis and Co., Ltd, Little Hulton Bolton. This includes a fine model of the "Bennis, and Miller-Bennett" improved smokeless chain grate stoker, which is specially applicable for furnaces of steam boilers, refuse destructors, and like purposes. The second exhibit consists of the "Bennis" patent stoker and compressed air furnace, which is shown applied to a Cornish boiler and is in active operation. The coal is supplied to the fire intermittently in very small quantities, and each time to a different part of the fire, the amount of feed being controlled by a simple adjustable cam on the right hand side of each stoker. The self-cleaning furnace shown is of the "Bennis" patent compressed air type, by which the supply of air is exactly adjusted to the evaporative requirements of the boiler. The third exhibit shown on this stand is the well-known "Darling" calorimeter, which the exhibitors claim is the simplest machine of the kind on the market.

SHIPBUILDING NOTES.

GREAT activity prevails in Messrs. Swan, Hunter and Wigham Richardson's covered-in shipbuilding berth at Wallsend-on-Tyne, where steady progress is being made with the construction of one of the Cunard Company's new leviathans. It is, of course, too soon to be able to give any detailed particulars, but the following are the liner's principal dimensions:—Length overall, 785 ft.; between perpendiculars, 760 ft.; beam, 88 ft.; and depth moulded, 60 ft. 6 in. She will have accommodation for over 500 first-class, 500 second-class, and about 1,200 third-class passengers. Accommodation will also be provided for a crew of about 800, so that when in actual service she will carry approximately 3,000. The propelling machinery, which will be on the Parsons Marine Steam Turbine Company's principle, is being constructed by the Wallsend Slipway and Engineering Company, Ltd., at Wallsend. The vessel will have four turbines driving four shafts, each having one propeller. The same facts apply to the sister ship which is being built by Messrs. John Brown and Co., Clydebank. Both vessels are designed to obtain a speed of not less than 24½ knots.

The London and Glasgow Engineering and Shipbuilding Company, Ltd., launched from their yard at Govan on Tuesday, a steel twin-screw passenger steamer for the Lloyd Italiano Societa di Navigazione, Genoa, for their passenger and cargo service between the Mediterranean and South American ports. The dimensions of the vessel are 400 ft. by 47 ft. by 29 ft. 6 in., moulded to spar deck, the gross tonnage being about 4,500 tons. The vessel is built to the highest class Bureau Veritas, and is fitted with double bottom for water ballast. As the vessel will trade through the tropics, special attention has been paid to the ventilation of the ship, electric fans being very largely utilized for this purpose. An installation of refrigerating machinery, with the necessary insulated chambers of large size, is also provided. She will be fitted by the builders with two sets of triple-expansion engines. As the vessel left the ways, she was named the *[illegible]*.

On Tuesday, Messrs. Irvines Shipbuilding and Dry Docks Company, Ltd., West Hartlepool, launched the steel screw passenger and cargo steamer *Sieglindo* for the Dampfschiffs Rhederei "Union" Aktiengesellschaft, Hamburg. She is the second of four vessels which Messrs. Irvines Shipbuilding Company have in hand for the above owners, and is intended for the North and South American trade. The following are her chief dimensions:—Length, 332 ft.; breadth, 45 ft.; and depth, 24 ft. 9 in., moulded, classes 100 A 1 to Germanischer Lloyd's highest class, having cellular double bottom all fore and aft, with fore and after peak tanks. She has nine steam winches and sixteen derricks, and each derrick is fitted with purchase gear, two being capable of lifting 15 tons and the remainder 7 tons each. Steam steering gear is placed amidships, screw gear after, quick warping windlass forward and polo masts of steel from heel to pole. Engines of the triple-expansion type are being supplied and fitted by Messrs. Richardsons, Westgarth and Co., Ltd., Hartlepool, having cylinders 23½ in., 38 in., and 64 in. by 42 in. stroke, steam being supplied by three large main boilers working at a pressure of 180 lb. per square inch.

Messrs. Wm. Doxford and Sons, Ltd., Sunderland, recently launched their 128th turret vessel, the s.s. *Komura*, built to the order of Messrs. McIlwraith, McEacharn and Co. Ltd., London and Melbourne, for their Australian trade. She [illegible] ft. in length, 40 ft. in breadth, and of 22 ft. moulded depth, and is designed to carry 3,500 tons of cargo and bunker coal on a draft of 19 ft. The engines and boilers are also supplied by Messrs. Doxford, and the British Corporation Registry has assigned its highest classification to the vessel.

The third of the vessels built by Messrs. Wood, Skinner and Co., Ltd., of Bill Quay-on-Tyne, to the order of Messrs. Dampskibsselskabet Steam, of Copenhagen, left the Tyne on Saturday for her official trial trip. The s.s. *Taarnholm* is of the single deck type, with full poop and extended bridge in one, also topgallant forecastle. Water ballast is provided in the cellular double bottom, and the vessel is rigged as a two-masted schooner. The propelling machinery, which has been constructed and fitted at the Northumberland Engine Works, Wallsend, of the North Eastern Marine Engineering Company, Ltd., consists of a set of their latest type of triple-expansion engines, having cylinders 19 in., 31 in., and 51 in., by 33 in. stroke, steam being supplied by two large steel multitubular boilers, working at a pressure of 180 lb. per square inch. Both the hull and machinery have been constructed to the requirements and under special survey of Lloyd's to take their highest classification. On the trial run the machinery gave every satisfaction.

MOTOR NOTES.

THORNYCROFT 5-TON LORRY.

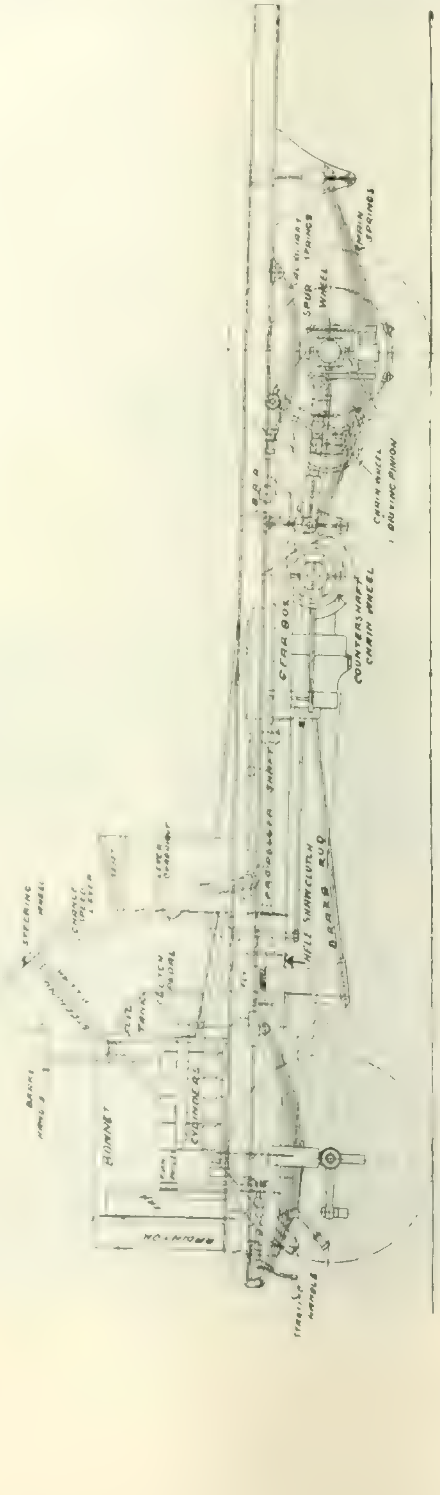
The commercial motor vehicles of this firm are now well known, and although the engine in the 5-ton lorry differs from that used in the steam wagons, the construction of the vehicle itself and the method of transmission of power from the engine to the wheels is precisely the same in principle. The frame is of channel section steel, suitably tied and braced; a supplementary underframe is provided, to which the engine and gear-box are bolted. Heavy ground plate springs of the semi-elliptic type are employed. In the case of the leading axle the rear ends of the springs are bolted to sliding slippers; a practice which enables shocks to be absorbed without unduly straining any particular leaf.

The main driving wheel springs consist of 12 leaves and are free at both ends; they are secured to the axle boxes by means of two pairs of strap bolts, the axle being held in position by means of two adjustable radius rods. A pair of auxiliary springs are also fitted. These springs are normally about 3in. above the axle box, and are consequently only brought into play when travelling over rough ground or with very heavy loads.

Irreversible steering by means of a worm and quadrant is fitted, and the steering gear throughout is particularly substantial. The throttle and spark-regulating levers are placed in an accessible position on a bracket bolted to the dash-board; the levers being connected to the throttle spindle and to the ignition gear by means of steel wires. The change-speed lever is on the left-hand side of the driver, and as the "gate" system is employed, the travel of the lever is short; this system, in conjunction with the friction disc clutch, making gear changing a very simple operation. A stop is provided to cover the reverse slot, the object of this being to prevent the driver inadvertently bringing the reverse into operation when running; this stop can easily be raised when required. The lorry is provided with two brakes, a foot-lever brake operating on the counter-shaft brake drum and a powerful screw-down brake acting on a drum of large diameter keyed and bolted to the back axle. The former is used for all ordinary work, while the latter is provided for emergencies and for holding the vehicle on hills.

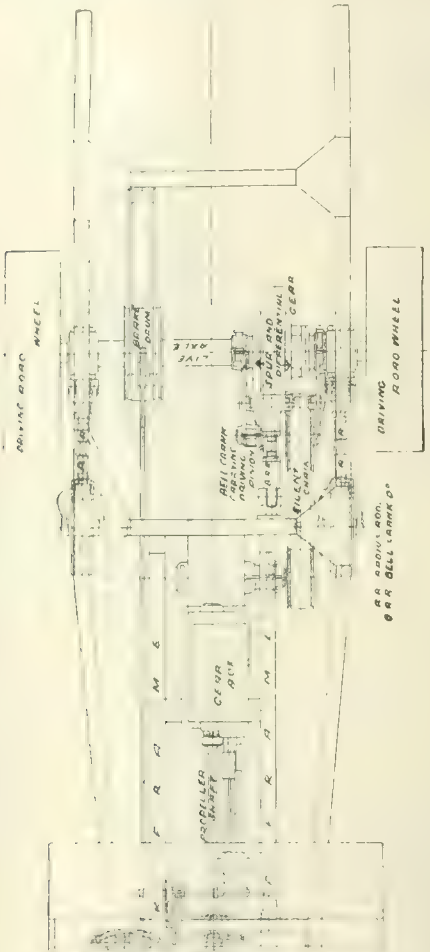
ENGINE.

The engine is a 24-h.p. four-cylinder enclosed water-cooled motor, having a bore and stroke of $4\frac{1}{4}$ in. by 5 in., designed to run at a normal speed of 900 revolutions a minute, and capable of considerable acceleration. Each cylinder with its water jacket is a separate casting, thus giving greater freedom for expansion and lessening the risk of distortion. At the same time provision has been made for the efficient circulation of the



CHASSIS' 5-TON THORNYCROFT LORRY.

cooling water, and no corners are left where dead water could lie, or where steam pockets could possibly be formed. The induction and exhaust valves, which are all mechanically operated, are placed on opposite sides of the cylinders, and the valves themselves are made interchangeable, thus reducing the number of "spares" it may be desirable to carry. Half-speed cam shafts are arranged on both sides of the crank chamber casing, and are driven from the crank shaft. These cam shafts operate the inlet and exhaust valves respectively through rods working in long guides, which give steady support and prevent loss of oil, hard steel rollers being fitted between the ends of the rods and the cams to diminish friction and wear.



PLAN OF THORNYCROFT 5-TON MOTOR LORRY.

The carburetter is of the float-feed type. An efficient water jacket is fitted, which, together with the care taken to avoid any pockets, ensures the immediate vapourisation of any excess of petrol.

The clutch is of the multiple friction disc type, and is remarkably smooth in coming into action, yet positively secure when fully engaged. It is completely encased and runs in oil.

The power is transmitted to the gear-box by means of a short cardon shaft, having a stout universal joint of special design at each end.

GEAR BOX.

The gear-box provides for four changes of speed, viz., 2¼, 4, 6 and 9 miles per hour, the reverse being geared at 1½ miles per hour. A powerful bevel drive actuates the shaft carrying the driving chain pinion, the drive from the countershaft being taken by means of a Renold silent chain to a floating sprocket wheel on the bell crank driving bracket, which is mounted on the rear live axle. The final drive is by means of double helical pinion and ring, the latter being mounted directly on the differential gear centre. In order to obviate any strain on the naves or spokes of the wheels, the Thornycroft patent "spring drive" is employed. The road wheel is mounted freely upon the end of the live axle, and instead of being driven direct from it, two elliptic springs are employed. These springs are securely bolted to a square upon the axle and transmit the drive directly to the felloe brackets. Owing to the comparatively low speed of the axle in relation to the engine, the crank shaft is enabled to turn considerably while the pressure on the springs gradually increases, and the load is therefore taken without any sudden shock.

MARINE MOTOR.

We illustrate on page 1308 the Thornycroft marine motor, type D 4. The following description applies in general to the Thornycroft types of marine motors.

¶In general the cylinders are of iron and with their water jackets are cast together, in some cases singly, and in other cases in pairs. The water jacketing extends about half-way down from the firing end, and has been designed to avoid "pockets" and to allow a free and natural run for the cooling water, which is circulated round the cylinders by a gear-driven positive action enclosed pump. The pistons are of cast iron, and each is fitted with several cast-iron spring rings, thus obviating any chance of gas leaking past the piston.

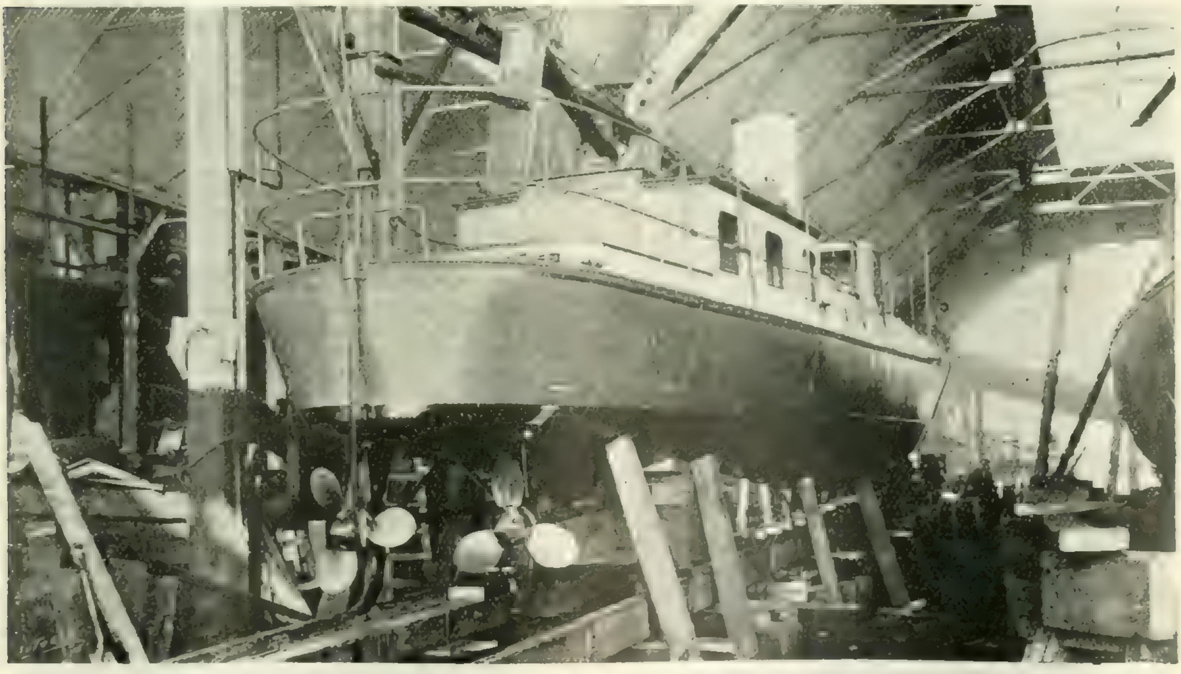
The connecting rods are of double tee section, stamped in steel, with gudgeon and big-end bearings phosphor-bronze bushed, the big-ends being adjustable. The crankshaft is of special steel, in one piece, machined from the solid and provided with ample bearing surfaces.

The cylinders are bolted in a vertical position directly to the bedplate, which is made of cast iron where weight is not of importance, or of aluminium where lightness is a consideration. The bedplate forms a completely enclosed oil-bath crank chamber. The camshafts, etc., are arranged in the bedplate, and are lubricated by the same arrangement as the other moving parts, though in some cases the camshafts have each a distinct cover. All valve stem guides are very long in order to ensure steady support and to prevent loss of oil. Between the cams and the end of the valve tappet rods hard steel rollers are inserted to diminish friction and wear. Gear wheels for driving half-speed shafts, centrifugal governor, circulating water, and oil pumps, are completely enclosed and are lubricated from the crank chamber. Engines of small powers are started from rest by means of a crank handle with a chain and free-wheel arrangement placed in a convenient position. In the case of the larger engines provision is made for starting them by a separate small motor, either directly or through the medium of compressed air.

On this page we illustrate the preparations for the launch of the twin-screw 200-h.p. motor cruiser. This is a powerful fast cruiser of the completely decked type, capable of keeping the sea in almost any weather. Crew space is provided forward and a comfortable cabin for passengers aft. These vessels can be well arranged to use kerosene fuel, in which case the b.h.p. would be reduced by about one-quarter.

PARIS MOTOR SHOW.

The eighth annual Paris motor exhibition, at the Grand Palais, Champs Elysées, has been a wonderfully successful show, and if the English section was not important in numbers, it was at all events an advance on the previous year. Among exhibits that attracted a good deal of attention, were those of the Napier, the Wolseley, the Star, the Humber, and the Argyll Companies. Messrs. Edge did not show direct, but were represented on the Paris automobile stand. The Napier speciality for next season is, of course, the 40-h.p. 6-cylinder car, and with this, and other English exhibits at the Paris show, we shall deal at some length in our next issue. No doubt, the English exhibits would have been more numerous had the exhibition at Olympia and that at Paris been separated by a longer period. It is certainly open to doubt whether the arrangement by which the two exhibitions follow one another so closely, is altogether advisable.



TWIN-SCREW 200-H.P. MOTOR CRUISER READY FOR LAUNCHING.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Last Day.

Manchester.—Supply, delivery, and erection of the following, for the Electricity Committee : (a) one group of three single-phase transformers of 200 k.w. each, constituting one complete 600 k.w. three-phase transformer ; (b) high and low tension switchboards for three-phase transformer sub-station. Mr. F. E. Hughes, secretary, Electricity Department, Town Hall, Manchester ... ... Dec. 19

Manchester.—Supply of permanent-way points, tongues, and hardened steel centres, for the Tramways Committee. Mr. J. M. M'Elroy, general manager, Tramways Department, 55, Piccadilly, Manchester ... ... Dec. 23

Salford.—Provision and erection of steelwork, wrought and cast ironwork, brickwork, masonry, etc., required in the reconstruction of two bridges carrying Frederick-road, Pendleton, over the Lancashire and Yorkshire Railway Co.'s line between Manchester and Bolton and the Manchester and Bolton and Bury Canal, for the Building and Bridges Committee of the Salford Corporation. Messrs. C. S. Allott and Sons, 46, Brown-street, Manchester ... ... Dec. 27

Elham (Folkestone).—One or more superheaters for the Elham Union ; also a Lancashire boiler. Mr. R. Lonergan, clerk, 11, Cheriton Place, Folkestone .... Dec. 27

Grimsby.—For plant, buildings, and cables to the following specifications, for the Corporation : (Specification No. 35) engine and dynamo—500 k.w. continuous-current dynamo direct-coupled to high-speed double-acting engine ; (36) water-tube boiler and underfeed stokers ; (37) extension of switchboard ; (38) condensing plant—surface type ; (39) buildings——bills of quantities for extension of engine-room, new coal bunkers, and new store ; (43) pipework ; (44) coal-conveying plant—two scraper conveyors and one elevator ; (45) supply of cables (lead-covered, paper-insulated). Mr. W. A. Vignoles, borough electrical engineer, Corporation Electricity Works, Grimsby... Jan. 5

Hamilton (Scotland).—For the removal of the present bridge carrying the Sandford highway over the Kype Water, and the construction of a new steel girder bridge in lieu thereof, for the District Committee of the Middle Ward of the County of Lanark. Mr. W. L. Douglass, C.E., district engineer, District Offices, Hamilton ... ... Jan. 5

Last Day

West Hartlepool.—For the works required in connection with the reconstruction of No. 4 graving dock, West Hartlepool, for the North-Eastern Railway Co. Plans may be seen and copies of the specification and quantities obtained on personal application only to Mr. T. M. Newell, engineer, Dock Office, Hull ... Jan. 10

COMING CONTRACTS.

Dublin.—An inquiry has been held into the application of the Corporation to borrow (inter alia) £100,000 for electric lighting extensions and £4,900 additional for utilising the tramways in connection with the cleansing system of the city.

Marylebone. — The Electric Supply Committee report that additional generating plant will shortly be required as follows : (*a*) A ninth Parsons turbine at the generating station, £10,000 ; (*b*) storage battery at North Street sub-station, £10,000 ; (*c*) storage battery at Rathbone Place sub-station, £5,000 ; (*d*) two boilers at generating station, £9,000.

Sunderland. — The borough electrical engineer (Mr. J. F. C. Snell) has reported to the Electric Lighting Committee on further extensions of plant required at Hylton Road power station. Mr. Snell recommends the installation of four new boilers and other plant at an estimated cost of £16,000. There is also to be some alterations to existing machinery, to cost about £2,000.

Carlisle.—The corporation have received the Local Government Board's sanction to the borrowing of the money required to cover the cost of the scheme for the treatment of the whole of the sewage of the city on the bacteriological system. The sum which the Local Government Board have agreed to allow the corporation to borrow is £52,500

Swansea.—The corporation having applied to the Local Government Board for sanction to borrow £715 for refuse destructor purposes, £14,027 for works of water supply, an inquiry has been held.

CONTRACTS CLOSED.

London, Brighton, and South Coast Railway.—An important contract in connection with the electrification of the suburban system of this railway has been given to the Allgemeine Elektricitäts-Gesellschaft, of Berlin.

Barrow.—In connection with the proposed extensions, the Town Council has accepted the following tenders Vickers, Sons Maxim, £2,864 ; Babcock and Wilcox, £1,228 ; Phœnix Dynamo Co., £247 ; James Hodgkinson, Ltd., 210 ; Hitchen and Sons, £392 ; Herbert Morris and Bastert, Ltd., £261.

Beckenham.—The Urban District Council have accepted the following tenders : General Electric Company, engines and dynamos, £1,256 ; Mirrlees and Watson, condensers, £1,402 ; Elliott Brothers, switchboard, £545 ; Brush Electrical Engineering Company's amended tender for machinery ; and Babcock and Wilcox, boilers, £3,375, pipe-work, £1,750.

Whitchurch near Cardiff.—The A[illegible] Committee of the Corporation have accepted the following tenders: Electrical Power Storage Company, batteries, [illegible]; Siemens Bros. and Co., engines and generators, £11,998; General Electric Company, [illegible]board, £527.

Shoreditch.—The Borough Council have accepted the following tenders for the extension of plant at their Whiston Street generating station: Contract No. 34: Three water-tube boilers, superheater, etc., Stirling Boiler Company, £6,605; Contract No. 35: Steam and water pipes, valves, etc., Stirling Boiler Company, £1,175.

Barrow.—An order for [illegible] of the [illegible] has been [illegible] by Messrs. Vickers, Sons and Maxim for the [illegible] Admiralty. The [illegible] in course of construction at Barrow [illegible] to be very fast vessel [illegible] the test will be [illegible] held in the spring of next year.

Stockton-on-Tees.—The A.B.C. Accumulator Company report the following orders: 480 cells, [illegible] plate, S type for Dumbarton; 20 cells, 5 plate, S type for Derby; 55 cells, 17 plate, S type for Oxford; 110 cells, 25 plate, S type for Croydon; 54 cells, 9 plate, S type for Tain, N.B.; 54 cells, 23 plate, C.S. type for Ealing; 54 sections, renewals for Newcastle; and [illegible] cells, 7 plate, L type, for South Africa.

Charlton (Kent).—Messrs. Johnson and Phillips, have secured the undermentioned contracts: the contract for conduits, feeder and arc lighting cables, underground boxes, and lamp pillars for Portland Coaling Depot; for the supply of motors, transformers, and complete electrical plant for Lillooah, for the East Indian Railway Company.

APPOINTMENTS VACANT.

Cape Town.—Applications are invited for the newly-founded Professorship of Electro-Technics in the South African College, Capetown. Salary £600 per annum. Agent-General for Cape Colony, 100, Victoria Street, London, S.W. Dec. 15

Cork.—The Cork County Borough Council will receive applications for the office of resident mechanical engineer at the pumping station, Cork Waterworks. Salary, commencing at £200 per annum ... .. Dec. 21

India.—Bombay, Baroda, and Central India Railway Company, invite applications for appointment as a chief draughtsman, in the carriage and wagon department of the company's service. Salary Rs. 400 per calendar month. Mr. T. Wood, secretary, Gloucester House, Bishopsgate Street Without, E.C. ... ... —

Burma Railways.—The Directors of the Burma Railways Co. invite applications for appointment as assistant carriage and wagon superintendent, to take charge of the carriage and wagon shop at Insein, under the locomotive and carriage superintendent. Mr. A. G. Begbie, Managing Director, 76, Gresham House, E.C. Dec. 21

Pontypridd.—The Urban District Council invite applications for the position of third charge engineer in the electric light and tramways power station. Engineer and manager, Church Street, Pontypridd Dec. 27

Auckland, New Zealand.—Applications are invited for the appointment of [illegible] of Auckland. [illegible] New Zealand, Westminster Chambers, 13, Victoria [illegible] S.W. [illegible]

APPOINTMENTS FILLED.

Barking.—Mr. Henley L. Howard, assistant-engineer to the Manchester Corporation Electricity Department, has been appointed chief engineer and general manager to the Electricity and Tramway Department.

Battersea.—Mr. Frederick H. Andrews, of the East London Technical College, has been appointed head of the department of arts and crafts at Battersea (London) Polytechnic.

Cheltenham.—Mr. R. J. Roberts, of Merthyr Tydvil, has been appointed junior charge engineer at Cheltenham electricity works.

Bolton.—Bolton Council have appointed Mr. C. Barry as engineer-in-charge at the electricity works.

Gloucester.—Mr. J. C. Whiteley, of Huddersfield, has been appointed manager of Gloucester Council light railways at £220 a year.

Cawnpore.—Mr. Wilfred H. Shipp, assistant to the borough engineer of Woolwich, has been selected by Mr. [illegible] E. Priest, M.Inst.C.E., of Liverpool, to fill the post of assistant municipal engineer at Cawnpore.

Birmingham.—Mr. Edgar J. Kipps has been appointed assistant lecturer on electrical machine design, at Birmingham University a teaching post recently established by the Council, on the recommendation of Professor Kapp. Mr. Hamilton McCombie has been appointed lecturer and demonstrator in chemistry to succeed Dr. Alexander McKenzie, who has been appointed head of the chemical department in the Birkbeck College, London; and Mr. Thomas J. Murray, Ph.D., has been appointed lecturer and demonstrator in chemistry to succeed Mr. T. S. Moore, who has been elected to a Fellowship in Chemistry at Magdalen College, Oxford.

London.—Mr. McRow, the new secretary of the Royal Agricultural Society, has been secretary of the Royal Agricultural Hall, Islington, for two years.

Gloucester.—The City Council, on November 29th, appointed Mr. Leonard Johnston, of Blackburn, as general manager of the tramways, at a salary of £250 per annum, rising by £25 a year to £300. An amendment favouring the amalgamation of the offices of electrical engineer and tramway manager was rejected.

Admiralty.—Mr. J. B. Marshall, C.B., will be appointed to succeed Sir James Williamson, C.B., on January 1st.; Mr. H. J. Webb, chief constructor at Chatham Dockyard will succeed Mr. J. Marshall as assistant to the director of dockyards and dockyard work; Mr. J. Black, chief constructor at Devonport, is to be appointed acting-manager of the constructive department at Chatham Dockyard; Mr. C. H. Andrews, manager of the engineering department, Devonport Dockyard, and Mr. G. Crocker, C.B., to be manager of the constructive department, Devonport Dockyard.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

Stock Exchange Settling Days.—Settling days on the Stock Exchange are as follows:—

Consols [illegible] General Settlement— Dec. 29th, Jan 11th, 25th. Bank Rate, September 28th, 1905, 4 per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices.
11,27[illegible]			Alldays & Onions Pneumatic Engineering, Ltd.	3	2[illegible] — 2¾
10,000	5	3/-	Do. Cum. Pref. 6 per cent.	5	4[illegible] — 5¼
8,210,000	1	[illegible]	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3[illegible] - 3[illegible]
76,970	5	[illegible]	Do. 4% Cum. Pref.	5	5[illegible] — 5[illegible]
1,5[illegible]	100	4	Do. 4[illegible] 1st Mort. Dbs. Rd.	100	103 —105
£100,000	100	4½	Aveling and Porter, Ltd., 4½% Reg. Mt. Debs. Red.	100	96 — 99
530,000	1	1/[illegible]	Babcock and Wilcox, Ltd., Ord.	1	3¾ – 4
100,000	1	7½d.	Do. ,, 6% Cum. Pref.	1	1[illegible] - 1[illegible]
20,[illegible]	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	5 — 5½
250,000	1	6[illegible]d.	Baldwins, Ltd., 5½% Cum. Pref.	1	1[illegible] – 1[illegible]
£250,000	Stk	4½	Do. 1st Mt. 4½% Deb. Stk. Red.	100	102 —104
150,000	4½		Barrow Hæmatite Steel Co., Ld., O	4½	5 — 5¼
50,000	4½	3	Do. do. Cum 2nd. Pref.	4½	[illegible] — [illegible]¼
83,334	[illegible]	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾—5¼
£500,[illegible]	[illegible]	4½	Beardmore (Wm.) & Co., Ltd. 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	104—106
50,000	10	6	Bell Brothers, Ltd., 6% Cum. Pref.	10	12¾—13¼
£366,600	Stk	4	Do 4% Deb. Stock, Red.	100	100—102
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	[illegible]
300,000	1	[illegible]	Do. 5½% Cum Pref.	1	[illegible]
£300,000	Stk	4½	Do. 4½% Red. Deb. Stock	100	93 —96
1,629,760	1	[illegible]d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	1[illegible] — 1[illegible]
1,860,900	1	3½d.	Do. Nos. 1,639,101-3,500,000	12/-	[illegible]
1,160,000	1	10[illegible]	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1⅜— 1½
590,000	1	1/2	Do. Ord., Nos. 1,160,001-1,750,000	1	1¾— 2
74,000	10	5/-	Do. 5 % Cum. Pref.	10	11¾ —12¼
154,50[illegible]	[illegible]	2/[illegible]	Cammell, Laird & Co., Ltd., Ord.	5	10¼ -10¾
232,50[illegible]	[illegible]	2/6	Do. 5% Cum. Pref.	5	5[illegible] — 5⅜
450,000	1	1/-	Clayton & Shuttleworth, Ltd., Ord.	1	[illegible] — 1[illegible]
70,000	5	2/[illegible]	Do. 5% Cum. Pref	5	5¾— 5[illegible]
£250,000	Stk	4	Do. 4% 1st Mort. Db. Stk. Red	100	100 -102
100,000	10	30/	Consett Iron Co., Ltd., Ord.	7½	35 – 36
57 031	10	10/-	Crossley, Bros., Ld., Ord 40340/97370	10	15¾—16
40,3[illegible]	10	[illegible]	Do. 5% Cum Pref.	10	11⅜—11⅝
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2¼ - 2[illegible]
1,259,594	1	[illegible]	Dorman, Long & Co., Ltd.	1	[illegible] — [illegible]
£400,000	[illegible]	4	Do. 4% 1st Mort. Perp. Deb. Stk.	100	92 —95
200,000		3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating	5	3¾— 4¼
250,000	1	[illegible]	Dunlop (James) & Co., Ltd., Ord.	1	[illegible]
300,000	1	[illegible]	Do. 6% Cum. Pref.	1	[illegible] - 1
4,721	13	13/-	Ebbw Vale Steel, Iron & Coal Co., Ltd	13	10½— 11½
[illegible]	10	10/-	Do. do. do.	10	8[illegible] — 9¼
20,[illegible]	10	8/-	Elliott's Metal, Ltd.	8	5 — 5¼
5,000	10	[illegible]	Do. Cum. Pref. 5%	10	8[illegible]— 9½
[illegible]	Stk	4	Do. Deb. 4%	100	90 — 94
25,000	10	[illegible]	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref.	10	11½—12
£2[illegible]	Stk	[illegible]	Do. 4½% Mort. Deb. Stk .Red.	100	100 —103
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord.	3	[illegible] - 4[illegible]
21,000	[illegible]	1/[illegible]	Do. 7½% Cum. Pref.	3	5[illegible] — [illegible]
1[illegible]	10		Galloways, Ltd., 5% Cum. Pref. [illegible]	10	7½ — [illegible]
£150 000	Stk	4	Do. 4% 1st Mort Deb Red.	100	[illegible] — [illegible]
1[illegible]	10	10/-	Greenwood & Batley, Ltd., Ord.	10	6½— 7
[illegible]	10	7	Do. 7% Cum. Pref.	10	10[illegible] — 11¼
[illegible]	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2[illegible] — 2[illegible]
[illegible]44,[illegible]		2/6	Do. 5% Cum. Pref.	5	6[illegible]— 6[illegible]
£1,850,500	Stk	4	Do. 4% Irred. Mort. Deb. Stk	100	106 — 10[illegible]
13,000		2/6	Gwynnes, Ltd., 5% Cum. Pref.	5	2[illegible] - 3¼
250,000	1	1	Hadfield's Steel F'dry Co., Ld., Ord.	1	3[illegible] — 4
20,[illegible]	10	4½	Do. 4½% Cum. Pref.	10	10½— 11
[illegible]	5	[illegible]	Hall (J. & E.), Ltd. 6% Cum. Pref.	5	4[illegible] — 5¼
10[illegible]	1	1/[illegible]	Harvey United Steel Co., Ltd.	1	[illegible] — 1
47,500	10	7[illegible]	Hawthorn, Leslie & Co., Ltd. Ord.	10	9[illegible] —100
28,001		7	Head, Wrightson & Co., Ltd.	5	5¼ — 6
[illegible]	1	7[illegible]d.	H[illegible] (1899) Ld., Ord.	1	[illegible] — [illegible]
18,000		[illegible]	Do. [illegible] Cum. Pref.	5	[illegible] - 5[illegible]
£100,000	[illegible]		Hornsby (Richard) & Sons, Ld., Ord. 6% Cum. Pref.	100	101—103

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices.
750,000	1	7[illegible]	Howard & Bullough, Ltd., Ord.	1	1[illegible] — 1[illegible]
25,000	10	6/-	Do. 6% Pref. (Non-Cum.)	10	12½—13
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	98 — 101
37,500	10	20	Kynoch, Ltd.	10	18¼—18¾
49,537	10	5%	Do. Cum. Pref. 5%	10	10[illegible] — 11
300,000	1	4½d	Lambert Bros., Ltd., Ord.	1	[illegible] — [illegible]
50,000	5	2/9	Do. 5½% Cum. Pref.	5	4¼ — 4[illegible]
40,000	3	2/1½	Leeds Forge Co., 7% Cum. Pref.	3	4 — 4¼
200,000	1	7½d	Lysaght (John), Ltd., 6% Cum. Pf.	1	1[illegible] — 1[illegible]
£300,000	Stk	4½%	Do 4½% 1st Mt. Deb. Stk., Red.	100	110 —112
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11¼—11[illegible]
210,000	1	[illegible]d.	Measures Bros., Ltd., Ord.	1	[illegible] — 1[illegible]
75,000	1	6½d.	Do. 5½% Cum. Pref.	1	[illegible] — 1[illegible]
£75,000	Stk	4½	Do. 4½% 1st Mrt. Db. Stk. Red.	100	98 — 101
21,943	5	2/6	Muntz Metal, Ltd.	5	4[illegible] — 5¼
14,248	5	5%	Do. Pref. 5%	5	4¾— 5¼
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	78 - 81
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12⅜—12[illegible]
80,000	5		North-Eastern Steel Co., Ltd.,		
£250,000	Stk	4½	4½% 1st Mrt. Db. Stk., Red.	100	89 - 93
122,000	5	1/6	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	5 — 5¼
50,000	5	3/-	Do. 6% Cum. Pref. "A"	5	6 — 6[illegible]
70,000	10	10/-	Pease & Partners, Ltd., Ord.	10	13—13½
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	99—102
20,000	5	3/-	Peebles (Bruce) & Co., Ld., 6% Cm. P.	5	4⅞— 5⅛
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord	1	10/3—10/9
13,000	5	—	Do. 5½% Cum Pref.	5	4⅝— 4[illegible]
230,000	1	—	Projectile Co. (1902), Ltd., Ord.	1	[illegible] — ½
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	2[illegible] — 2[illegible]
73,062	5	2/-	Do. New	5	1[illegible] — [illegible]
£330,000		5%	Do. 5% Mort. Deb., Red.	100	102—104
350,000	1	1/2	Richardsons, Westgarth & Co., Ltd., Ord. 350,001—700,000	1	1 — [illegible]
£350,000	1	7½	Do. 6% Cum. Pref.	1	[illegible] — 1
£350,000	Stk	4½	Do. 4½% Perp. Deb. Stock	100	98 — 101
35,000	10	12/-	Ruston, Proctor & Co., Ltd.	10	10½— 11
275,000	1	6d.	Scott (Walter) Ltd., Ord.	1	[illegible] —
300,000	1	7½d.	Do. 6% Cum. Pref.	1	1 — 1[illegible]
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	94 — 97
£115,800	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs., Red	100	94 — 97
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	98 - 10[illegible]
250 000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	1[illegible] — 1[illegible]
300,000	1	1/2[illegible]	Do. 6% Cum. Pref.	1	[illegible] — 1[illegible]
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	93 — 96
25,000	10	-	Stephenson (Robert) & Co., Ltd., Or.	10	2[illegible] - 2[illegible]
25,000	10	5/6	Do. 5½% Cum. Pref.	10	4[illegible] - 5[illegible]
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	[illegible] - 83
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord.	10	19[illegible] - 1[illegible]
55,000	10	6/-	Do. 6% Cum. Pref.	10	14½— 15
684,732	1	6d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	[illegible]
538,845	1	6d.	Do. 5% Cum. Pref.	1	[illegible] — 1
£240,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	96 — 99
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., [illegible] Cum. Pf.	1	[illegible] - [illegible]
£200,000	100	4	Do. 4% Irredeem. 1st Mort. Deb.	100	80 - 84
£148,500	1	7½d.	Thornycroft (John I.) & Co., Ltd. Or.	1	[illegible]
£160,000	1	7½d.	Do. do. 6% Cum. Pref.	1	[illegible] - [illegible]
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9¼ - 9[illegible]
$50[illegible]	$100	[illegible]	United States Steel Corp. Com. Stk.	$100	40⅛ - 40[illegible]
$360314100	$100	[illegible]	Do. 7% Cum. Pref. Stock	$100	109 —109½
$1622[illegible]	$1000	[illegible]	Do. 10-60yr. 5% Skg. Fd. G. Bds.	$1000	99 - 101
3,350,000	1	1/-	Vickers, Sons & Maxim, Ltd. Ord.	1	2[illegible] — 2[illegible]
750,000	1	6d.	Do. 5% Non-Cum. Pref.	1	1[illegible] — 1[illegible]
£750,000	Stk	[illegible]	Do. 5% Non-Cum. Pref. Stock.	106	121 —124
£1,250,000	Stk	4	Do. 4% 1st. Mort. Deb. Stk. Red.	100	103 —105
£1,000,000	100	4½	Do. 4½% 2nd Mort. Debs., Red.	100	103½—105[illegible]
225,000	1	1/2[illegible]	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	1[illegible] - 1[illegible]
500,000	1	7[illegible]	Do. 6% Cum. Pref. Ord.	1	1⅛ - 1[illegible]
£300,000	Stk	4	Do. 4% Perpetual Deb. Stock	100	92 — 95
66,666	[illegible]	3/-	Willans & Robinson, Ord.	5	1½ - 2
66,666	[illegible]	3/-	Do. 6% Cum. Pref.	5	2½— 3½
£246,641	Stk	4	Do. 4% 1st Mort. Deb. Stk. Red	100	82 — 87*
£150,000	Stk	4½	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	10	77 —79

Stocks and Shares marked * are quoted [illegible]

II.—ELECTRICAL MANUFACTURING COMPANIES.

[illegible]	Shares	Last Dividend	Name	Paid up	[illegible]
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	[illegible]
1[illegible],000	1	7½d.	[illegible] Elec. Meter Ltd., [illegible] Cum. Pf.	1	[illegible]
120,000	1	1 2½	Bell's Asbestos Co., Ltd.	1	1[illegible]
[illegible]	[illegible]	[illegible]d	[illegible] Aluminium Co. 7% Cum Pref.	[illegible]	[illegible]
£[illegible]	Stk	5%	Do. 5% 1st Mort. Deb. Stk. Rd.	100	[illegible]
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord.	5	[illegible]
100,000	5	3/-	Do. 6% Cum. Pref	5	[illegible]
£[illegible]	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Rd.	100	[illegible]
£[illegible],000	Stk	4½%	British Thomson Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	[illegible]
400,000	[illegible]	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 8% Pref.	5	[illegible]
£616,353	Stk	4%	Do. 4% Mort. Deb. Stk. Red.	100	[illegible]
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord.	2	[illegible]
159,000	2	2 4½	Do. 6% Pref.	2	1[illegible] 2
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk.	100	96 100
£1[illegible],000	Stk	4½%	Do. 4½ Perp. 2nd Deb. Stk.	100	84 — 86
35,000	5	[illegible]	Callender's Cable & Constn. Ltd. Ord.	5	11 — 12
40 000	5	2/6	Do. 5% Cum. Pref.	5	5[illegible]
£[illegible]	Stk	4½	Do. 4½ 1st Mort Deb Stk. Red.	100	109 -111
85,000	3	1/6	Crompton & Co., Ltd.	3	2 — 2¼
£100,000		5%	Do. 5% 1st Mort. Reg. Debs.	100	97—100
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord.	5	[illegible]
61,000	[illegible]	3/-	Do. 6% Cum. Pref.	5	[illegible]
£300 000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	106 —108
233,334	1	6d.	Doulton & Co., Ltd., 7% Cum. Pref.	1	1½ 1¾
£233,334	Stk	4%	Do. 1st Mort. 4% Irre. Deb. Stk.	100	107 110
99,261	5	1 6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	1½ - 1¾
17,139	5	2/6	Do. "A" Shares Nos. 01-017 139	5	2 — [illegible]
£344,023	Stk	4%	Do. 4% Deb. Stock Red.	100	85 — 90
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	[illegible] 97
112 100	2	1 7½	Electric Construction Co., Ltd.	2	[illegible]
31,300	2	2 9½	Do. 7% Cumulative Pref.	2	1⅞— 2⅛
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	92 — 95
10,248	10	7/6	Evered and Co., Ltd.	10	9 — 11
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9[illegible]
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	96 10[illegible]
[illegible]	5	5/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	12 [illegible]
85,000	5	2/3	Do. 4½ Cum. Pref.	5	5½ - 5[illegible]
£50 000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	
50,000	10	5/-	India Rubber Gutta Percha & Telegraph Works Co., Ltd.,	10	18½ 19[illegible]
£300,000	100	4%	Do. 1st Mort. Deb. Red.	100	99 —102
7,500	10	–	Parker, Thos. Ltd.	10	6½— 7
100,000	1	3[illegible]	Scott (Ernest) & Mountain, Ld., Ord.	1	17 3 17[illegible]
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	32½ — 34½
[illegible]	100	4%	Do. 4% Deb. Bonds	100	102 104

III.—ELECTRIC TRACTION.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
120,000	5	3/-	Anglo Argentine Trams Co., Ld., Or.	5	5¼ 5½
200,007	5	2/6	Do. [illegible] Cum Pt.	5	5¼— [illegible]
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888	100	142 – 14[illegible]
20,000	10	12/-	Barcelona Trams Co., Ltd., Ord.	10	10¾ 11¼
10,000	10	5/-	Do. [illegible] Cum P. Shares	10	9¾- 10
£40,300	100	5%	Do. 5% Debs., Red.	100	98 - 101
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	97 —102
77,606	1	—	Bath Elec. Trams. Ld., Pt. Or.	1	[illegible] - 1
59,394	1	11·1d	Do. 5% Cum. Pf.	1	[illegible] 1[illegible]
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord.	5	1 - 1½
75,000	5	2/6	Do. 5% Cum Pt.	5	4 4½
£42[illegible]	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	95 — 98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	121—124
		5%	Pref. Ord. Stock	100	109—113
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	[illegible]
156,437	10	6/-	Do. 6% Cum. Pref.	10	10½ 11½
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk.	100	121 —123
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red.	100	98 —100
100,000	5	2/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3½ 3[illegible]
40,500	5	3/-	Do. "A" 6% Cum Pref.	5	5½ - [illegible]
27,000	5	3/-	Do. "B" do.	5	5 [illegible]
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	98—100
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	103 -107
[illegible]	[illegible]	[illegible]	Calcutta Tramways Co., Ltd.	[illegible]	[illegible]
£350,000	Stk	4½	Do. 4½ 1st Deb. Stk., Red	100	107 -109
[illegible]	1	6d.	Cape Electric Tramways, Ltd.	1	[illegible] 1½
40,000	[illegible]	2/6	City of Birmingham Trams Co., Ltd. 5% Cum. Pref.	5	[illegible]
£300,000	100	[illegible]	Do. 4% 1st Mort. Debs.	100	100 [illegible]
£120,000	Stk	[illegible]	Colombo Elec. Tram & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	101 [illegible]
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord.	10	13½—14½
59,987	10	6/-	Do. 6% Pref.	10	14½ 1[illegible]
£125,000	Stk	4%	Hastings & Dist. Elec. Trams. Co., Ltd., 4% Deb Stock, Red.	100	101 103
[illegible]	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	2½ [illegible]
£150,000	Stk	4%	Do. 4% Deb. Stock..	100	83 [illegible]
125,000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	10 11
£1,031 000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	100—103
60,007	1		London Motor Omnibus Co., Ltd., Ord. No. 1 - 60,007	1	2 [illegible]
£50,000	Stk	5%	Madras Electric Trams (1904) Ltd., 5% Deb Stock, Red.	100	103 —105
814,016	1		Metropolitan Elec. Trams, Ltd., Def.	1	
500,000	1	6d.	Do. 5% Cum. Pref.	1	1 - 1[illegible]
£350,000	Stk	4½	Do. 4½% Deb. Stock, Red.	100	10[illegible] 10[illegible]
[illegible],000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½— 1½
110,923	8	[illegible]	North Metropolitan Tramways Co.	8	4 4½
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	93 [illegible]
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red.	100	104 —107
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8¼ - 9¼
24,500	10	5/-	Do. 5% Cum. Pref.	10	9¾ 10¼
£220 000	Stk	4½	Do. 4½ Deb Stk., Red.	100	101 104
£160,000	Stk		Sunderland Dist. Elec. Trams. Ltd., 5% 1st Mort. Deb Red	100	9[illegible] 99
£277 000	Stk	12 11	Yorkshire (W. Riding) Elec. Trams Co. Ltd., 4½ 1st Deb. Stk., Red.	100	96 98

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
7*500	10	14/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord.	10	12½ 12[illegible]
7,500	10	4/6	Do. 4½% Cum. Pref.	10	[illegible] 10½
7,500	10	6/-	Do. 6% Cum. Second Pf.	10	11 - 1[illegible]
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red	100	107 —109
14,000	5	3/6	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼ - 5¾
£50,000	Stk	4½	Do. do. 4½% 1st Deb. Stk. Red.	100	102 1[illegible]
27,707	5	4 6	Brompton & Kensington Elec. Supply Co., Ltd. Ord.	5	9 — 10
12,493	5	3/6	Do. 7% Cum. Pref. Shares	5	9 — 9½
60 000	5	[illegible]	Calcutta Elec. Sup. Cor. Ltd., Ord.	5	9 — 9[illegible]
£288,782	Stk		Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk.	100	div [illegible] 102 —10[illegible]
70,000	5	2/6	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord.	[illegible]	[illegible]
[illegible],000	5	2/3	Do. do. 4½% Cum. Pref.	5	[illegible]
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	103 —105
41,436	5	2/3	Chelsea Elec. Sply. Co., Ltd., Ord.	5	5 — 6
£150,000	Stk	4½	Do. do. 4½% Deb Stk., Red	100	110 —112
70,595	10	7/-	City of London El. Lghtg. Co., Ld., O.	10	11½ 1[illegible]
40,000	10	6/-	Do. 6% Cum. Pref.	10	[illegible] - 14¼
£400,000	Stk	5%	Do. 5% Deb. Stk., Red	100	121 12[illegible]
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	103 - [illegible]
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	[illegible]
30,000	10	6/-	Do. 6% Cum. Pref.	10	[illegible]
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	112 —115
70,000	5	2 6	Edmundson's Elec. Cor. Ltd., Ord	5	[illegible]
70,000	5	3/-	Do. 6% Cum. Pref.	5	[illegible]
£300,000	Stk	4½	Do. 4½% 1st Mort. Db. Stk. Reg	100	10[illegible] 110
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	87 — [illegible]
10,000	5		Folkestone Elec. Supply Co., Ld., O	5	5¼ — 5¾
£[illegible] 000	Stk.	4½	Do. 4½% 1st Deb. Stk., Red.	100	101 —104
15,000	10		Havana Electricity Co., Ltd.	10	9 — 10[illegible]
13,000	5	5/-	Hove Elec. Lighting Co., Ltd., Ord.	5	[illegible]
£50,000	Stk	4½	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100 1[illegible]
150,000	1		Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	[illegible]
21,000	5	[illegible]	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord.	5	10 —11[illegible]

Stocks and Shares marked [illegible] are [illegible]-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed	Shares	Dividend	Name	Paid up	Closing Prices
£135,000	Stk	4	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	98 —101
111,000	3	1/9	London Elec. Supply Corp., Ld., Ord.	3	1¾—2½
60,000	5	8/-	Do. 6% Pref.	5	4¾—5¼
£371,895	Stk	4	Do. 4% 1st Mort.Db.Stk.,Red.	100	99 —102
100,000	10		Metropolitan Elec. Sup. Co.,Ld.,Or.	10	9¾—10¼
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5¼—5¾
220,000	Stk	4½	Do. 4½% 1st Mort.Db.Sk.,Red.	100	109 —113
250,000	Stk	3½	Do. 3½% Mort.Deb.Stk.,Red.	100	97 —99
£250 000		4½	Midland Elec. Corp. for Power Distribution Ld., 4½% 1st Mort.Deb.	100	101—103
10,852	10	8/-	Notting Hill Elec. Ltg. Co. Ltd.Ord.	10	14½—15½
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	98 —100
16,500	5	2/6	Oxford Electric Co. Ltd., Ord. ..	5	6¼—6¾
£50,000	Stk	4	Do. 4% Debenture Stk. Red.	100	100 —102
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½%, 20-yr. 1st Mort.Deb	100	100 —103
40,000	5	5/	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	12¾—13¾
23,000	5	3/6	Do. 7% Pref...	5	8 — 9
£150,005	Stk	3½	Do. 3½% Deben. Stock, Red	100	98 —100
12,000	5	4/	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2 — 2½
£50,000	Stk	4	Do. 4% Debenture Stk. Red.	100	76 — 80
65,000	5	4/-	South London Elec. Sup. Co.,Ltd.O.	5	3 — 3½
100,000	1		South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	13/16—15/16
50,000	1	8½d.	Do 7% Cum. Pref.	1	1 1/16—1 3/16
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	105 —108
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	4½—4¾
30,000	5	2/6	Do. 5% Cum Pref.	5*	5 — 5¾
£200,000	Stk	4½	Do. 4½% 1st Mort.Deb.Stk.Red	100	104 —106
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	11½—12½
28,151	5	2/6	Do. 5% Cum. Pref.	5	5¾—6¼

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed	Shares.	Last Dividend	Name	Paid up.	Closing Prices.
£34,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 —102
25,000	10		Amazon Telegraph Co., Ld... ..	10	3¾—4¼
£763,580	Stk	14/-	Anglo-American Tel. Co.. Ltd., Ord.	100	61 — 63
£3,118,210	Stk	28/-	Do. 6% Preferred Ordinary	100	109 —110
£3,118,210	Stk	2/-	Do. Deferred Ordinary ..	100	17⅛— 17⅜
44,000	5	5/-	Chili Telephone Co., Ltd.	5	7⅜— 7⅞
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	——
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk.,Red.	100	96 — 98
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8¾— 9¼
6,000	10	10/-	Do. 10% Preference	10	17 —18
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅜— 3⅝
		5/-	10% Cum. Preference	5	9 — 9½
£30,000	50	4½%	Do. 4½% Debs...	50	100-103%
60,710	20	4/-	Direct U.S. Cable Co., Ltd... ..	20	13¾—14¼
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	100½—102½
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	100—102
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	100—102%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	14½—15
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	106 —108
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	144 —147
£2,000,000	Stk	17/6	Do. 3 % Pref.	100	90 —92
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	106 —108
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	36 — 38
£58.700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	100½—102½
,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	57 —59
72.680	1	1d.	Monte Video Telephone Co.,Ltd.,O.	1	⅞ — 1
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	110½—111½
£1,966 667	Stk	5%	Do. Deferred	100	108 —110
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5⅜ — 5⅝
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	98 —100
£689,393	Stk	4%	Do. 4% do. do. ..	100	104 —106
179,313	1	7½d.	Oriental Telephone & Elec. Co.,Ltd.	1	1¼ — 1½
50,000	1	7½d.	Do. 6% Cum. Pref.	1	1 1/16—1 3/16
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	100—103
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7¼ — 7¾
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	7½ — 8
40,000	5	2/6	Do. 5% Cum. Pref.	5	5½— 5¾
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	111 —113
15,609	10	4/-	W. African Telegraph Co., Ltd. ..	10	9½—10
£30,008	2½		West Coast of America, Ltd. ..	2½	9/16 - 11/16
150,000	100	4%	Do. 4% Deb. Guar. by West.Tel.	100	100¼—102¼

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares	Last Dividend	Name	Paid up.	Closing Prices.
88,321	10	6d.	W.India&PanamaTeleg.Co.,Ld.,Or.	10	½— ¾
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	8¼— 8¾
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	6½ 7½
£80,000	100	5%	Do. 5% Deb.	100	101 —104
207,930	10	3/	Western Telegraph Co., Ltd.	10	14 —14½
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	102 —104
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	103 —105

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares	Last Dividend.	Name	Paid up.	Closing Prices
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	9¼— 9¾
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb.Stk.	100	99 —101
£672,900	Stk	4½%	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk., Red.	100	98 —100
10,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	6¼— 6¾
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	99 —101
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	12¾— 13¼
40,000	20	8/	Do. Nos. 60,001-100,000	10	5¾ — 6¼
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	102—104
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1⅛ — 1¼
25,328	7½	4/7	Gen.Steam Navigation Co., Ld., Ord.	7½	5 — 5½
36,758	8	4/9¾	Do. Non-Cum. 6% Pref.	8	8½— 9
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	98 —100
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	1 — 2
40,000	5	2/9	Do. 5½% Cum. Pref.	5	2¾— 3¼
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	87 — 90
141,500	10	5/-	Leyland (Fredk.), & Co., (1900), Ltd., 5% Cum. Pref. ..	10	5½ — 6
20,349	10	5/-	Orient Stm. Nav. Co., Ltd., Pref. Nos. 1-20,349 ..	10	7 - 7½
£103,100	Stk	4%	Do. 4% Deb. Stk., Red. ..	100	89—92
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	127 —130
£1,160,000	Stk	19%	Do. do. Deferred ..	100	247—250
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	45— 47
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾— 5¼
39,075	5	2/6	Do. "B" Ord...	5	3¾— 4¼
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8½— 9
24,000	10	4/6	Do. 4½% Cum. Pref... ..	10	10¾— 11¼
£1,008,894	Stk	4%	Do. 4% Debenture Stk.,Red.	100	101 —103

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed	Shares.	Last Dividend.	Name	Paid up.	Closing Prices
60,000	1	9½d.	Chadburn's (Ship) Tele. Ltd., Ord...	1	1 —1¼
£750,000	Stk	5%	General Hydraulic Power Co., Ltd.	100	123 —125
12,500	10	10/	Oakey (John) and Sons, Ltd., Ord..	10	25 — 28
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	¼ — ⅜
66,462	1	8·4d.	Do. do. Nos. 1-66,462	1	⅜— ½
135,000	1	6d	Waygood (R.) & Co., Ltd., Ord. ..	1	1 1/16 —1 3/16
135,000	1	7½d.	Do. 6% Cum. Pref. ..	1	1⅛—1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

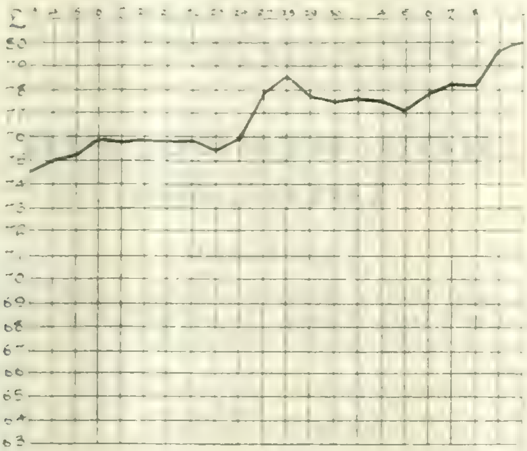
Present Amount Subscribed.	Shares	Last Dividend	Name.	Paid up.	Closing Prices.
10,000	10	7/6	Birm. Railway-Car, & Wagon, L., 1-10,000	10	25 — 27
8,739	10	3/-	Do. Second Issue 1-8,739....	4	
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13 —14½
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	10¼— 10¾
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4½— 4¾
14,567	10	1/3	Lancashire Wagon, Ord.	2	2¼ — 2¾
4,150	10	5%	Do. do.	10	10⅜—10⅝
781,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-781,808	1	43/6 44/0*
164,288	1	6d.	Do. Cum. A Pref. 5% 1-164,288	1	24/ —25/-*
285,000	1	7½d.	Do. Cum. B Pref. 6% 1-285,000	1	28/ —29/*
20,000	20	20/-	Midland Rail.-Car & Wagon, Ld., 1-20,000	10	20¾ — 21½

Stocks and Shares marked * are quoted ex-dividend.

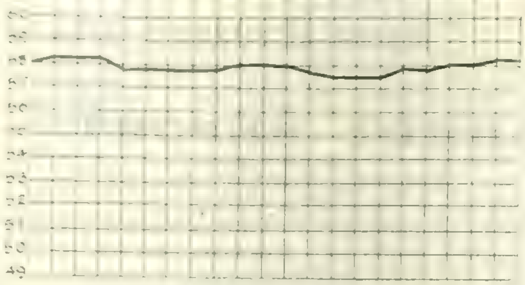
THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM NOVEMBER 13th TO DECEMBER 12th, 1905.

COPPER.



PIG IRON: SCOTCH.



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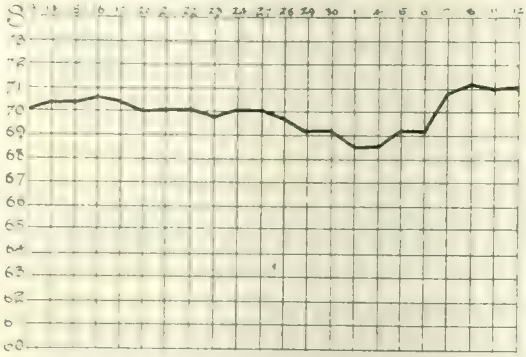

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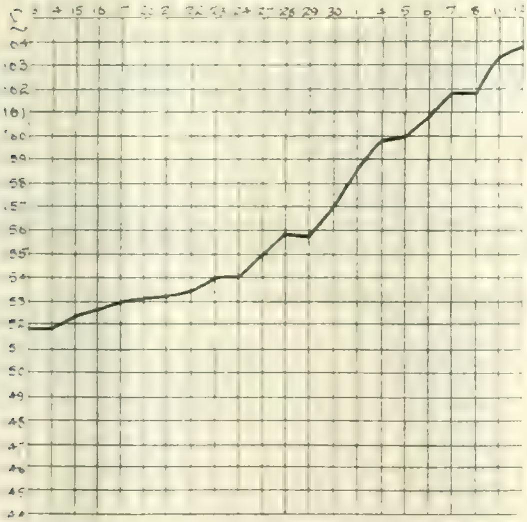
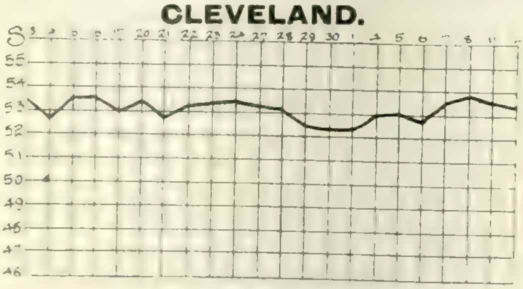
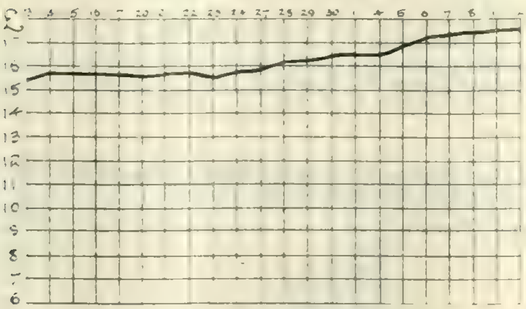


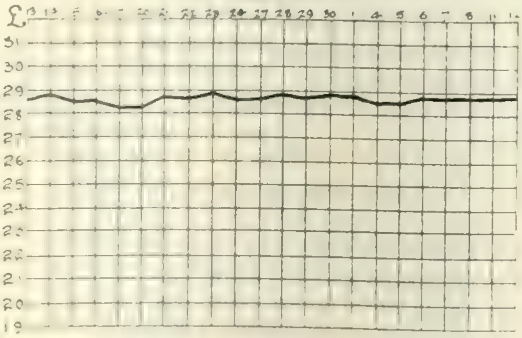
CLEVELAND.



ENGLISH LEAD.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, December 13th, 1905.

ALTHOUGH transactions in copper have been on a somewhat smaller scale than those recorded last week, there have been wide and frequent fluctuations, and this market is still the centre of interest. The prevailing sentiment is still bullish, and it is more evident than ever that the Amalgamated Copper Company is unable to control the position. The dearth of supplies makes it an easy matter for holders of warrants to hold the market, and it is clear that stocks in public warehouses will be at a very low level for some long time to come. Indeed, unless the output of copper increases very rapidly, Messrs. Merton & Co., are of opinion, that the dearth of the metal will be such as to develop into a serious calamity. The advance in values has been very rapid, and although at top prices there was some realization, the market rapidly recovered and cash metal has run up to £80 5s., with three months quoted at £79 5s.

The Tin market remains firm, and dealings have been on a large scale. The consumptive demand is enormous, and as in the case of the copper market, the leading dealers found it almost impossible to control the upward movement. As noted in our last issue the price paid for the Banca was over £160 per ton, the competition of buyers being very keen. The tendency of the quotations is still upwards, closing prices to-day being £164 cash, and £162 15s. three months.

Lead has been a rising market during the past week, an exceeding short supply of metal coinciding with good buying, with the result that the price of soft foreign prompt has advanced to £17 8s. 0d. Spelter remains steady, buying being on a somewhat smaller scale, but as offerings are certainly restricted, the price is likely to go higher on any increase in the consumptive demand. The latest quotations are G.O.B. prompt £28 15s. Galvanised iron has further advanced on active buying.

A large business has again been transacted in Cleveland Warrants and the price has risen to 53s. 4½d. while Hematite has improved to 71s. 1½d. This is due to rumours of the sale of a large quantity of Hematite iron to the States, but at the time of writing this is unconfirmed, and at present prices there really seems little inducement to import iron into America.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal:—

Steel:		£	s.	d.
DALZELL	Siemens' Steel Plates, Marine Boiler Quality	8	2	6
	,, ,, ,, Land ,, ,,	8	2	6
STEEL	,, Steel Bars Boiler Quality	8	5	0
DALZELL	Siemens' Steel Plates Ship Quality Plates	7	2	6
	,, ,, Bars ,, ,,	7	15	0
STEEL	,, ,, Angles	6	15	0

Manufactured Iron:

	£	s.	d.
Bars—Dalzell	7	2	6
,, Best	7	12	6
,, ,, Horseshoe	7	12	6
,, Angle	7	2	6
,, Best Angle	7	12	6
,, Best Best	8	2	6
,, Extra Best	8	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice

Malleable Common Bars:	£	s.	d.	
Dalzell, per ton	7	2	6	5 per cent.
Govan	6	10	0	..
North British	6	10	0	.
Drumpellier	6	7	6	..
Waverley	6	10	0	..
Crown	6	5	0	..
Dundyvan	6	5	0	..
Muirkirk	6	5	0	.
Rochsolloch	6	5	0	.
Phœnix	7	5	0	..
Coatbridge	7	2	6	..
Coats	6	5	0	..
Angle Iron				..
Steel Plates, ship				.
,, Boiler Plates				.
Rails				.
Railway Chairs		–		..

G.M.B. at Glasgow, No. 1, 64s., No. 3, 61s.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quote:—

	£	s.	d.
Bars—Phœnix	7	5	0
,, Best	7	15	0
,, Best Best	8	5	0
,, Extra Best	8	15	0
,, Best Horse Shoe	7	15	0
,, Extra B.H.S.	8	15	0
,, Extra Best Cable	9	5	0
,, Rivet	7	5	0
,, Best Scrap Rivet	8	5	0

	£	s.	d.
Angles—Phœnix	7	5	0
,, Best	7	15	0
,, Extra Best	8	5	0
Gas Tube Hoops—Phœnix Best	7	15	0
Plates—Phœnix	—		
,, Best Boiler	8	10	0
,, Best Best Boiler	9	0	0
,, Extra Best Boiler	10	0	0
Boiler Tube Strips—Phœnix	9	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote (Commission extra).

Pig Iron:	No. 1. £	s.	d.	No. 3. £	s.	d
Coltness, f.a.s. Glasgow	3	16	0	3	6	0
Gartsherrie ,,	3	8	6	3	3	6
Summerlee ,,	3	11	0	3	6	0
Carnbroe ,,	3	5	6	3	2	6
Langloan ,,	3	10	0	3	5	0
Calder ,,	3	7	6	3	2	6
Clyde ,,	3	8	0	3	3	0
Glengarnock, f.o.b. Ardrossan	3	8	0	3	3	0
Eglinton ,, ,,	3	3	0	3	0	0
Dalmellington, ,, Ayr	--			3	0	0
Shotts ,, Leith	3	7	6	3	2	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£	s.	d.
W.W ♔ Bars	7	5	0
W.W. Best Bars	7	12	6
W.W. Best Best	8	0	0
W.W. Best Best Best	8	7	6
W.W. Best Shoe	7	15	0
Thornaby ♔	8	15	0
Thornaby Best	9	5	0
Thornaby Best Best	10	5	0
Whitwell Special Admiralty Cable	10	15	0
Special Chain Iron	9	15	0
Tube and Nail Strip iron net cash	7	5	0
W.W. ♔ Angle Iron	7	7	6
W.W. Best Angle Iron	7	15	0
Tee Iron, to 8-inches United	8	5	0

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd., Dallam and Bewsey Forges, Warrington, quote as follows:—

		Iron. £	s	d.	Steel. £	s.	d
♔ (BNF)	Bars	7	10	0	7	15	0
	Angles	8	0	0	8	5	0
	Tees	8	10	0	8	15	0
♔ W.I.W	Hoops	7	10	0	8	0	0
	Sheets	8	15	0	9	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.

Extras for Sizes and Cutting as per List.

Lots under 10 cwts. of a size 10s. per ton extra.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

Black Sheets	Singles 20 G 96in. by 36in. per ton. £	s.	d.	Doubles 21 G to 24 G 96in. by 36in. per ton. £	s	d.
"Vale"	10	10	0	11	0	0
"Shield"	11	0	0	12	0	0
"Severn"	12	0	0	13	0	0
"Baldwin Wilden B."	13	0	0	14	0	0
Charcoal	17	0	0	18	0	0
Best Charcoal	19	0	0	20	0	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:	£	s.	d.	£	s.	d.
No. 3 Lead	14	0	0	15	0	0
S.V. Lead	15	10	0	16	10	0
No. 3 Terne	15	10	0	16	10	0
S.V. Terne	17	0	0	18	0	0

Tinned Sheets:	Singles 20 G to 108 by 36in. per ton. £	s.	d.	Doubles 21 to 24 G to 96 by 36in per ton. £	s.	d
Best Coke (Finish)	29	0	0	30	10	0
,, Charcoal (Finish)	31	0	0	32	10	0
Extra ,,	33	0	0	34	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Coo ley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.

At works.

Galvanized Corrugated Sheets:

	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	13	7	6	per ton
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	15	15	0	,,

Galvanized Working Up-Sheets:

	£	s.	d	
24 G., f.o.b. London, in Bundles	14	7	6	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£	s.	d.	
Crown Bars	7	5	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ to 4 in. rounds and squares)	7	15	0	,,
Angles	7	10	0	,,
,, Best	8	0	0	,,
T's	7	15	0	,,
,, Best	8	5	0	,,
Best Ship Iron	8	15	0	,,
,, Rivet Iron	8	15	0	,,
Best Rivet (Special)	10	0	0	,,
,, Cable	10	0	0	,,
Screwing	9	0	0	,,

	£	s.	d.	
Best [illegible]	8	15	0	per ton.
,, [illegible]	9	0	0	,,
Best Best	10	0	0	,,
Treble Best	11	0	0	,,
Plates	8	5	0	,,
Best Plates	8	15	0	,,
,, Boiler Plates	9	5	0	,,
,, Best Boiler Plates	10	5	0	,,
Treble Best Boiler Plates	12	15	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails steel nails, &c.

Discounts—

42½ per cent off 1 inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound

37½ per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

37½ per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—

2 tons 10/6 per cwt.
4 cwt. lots and upwards 10/9 per cwt.
} d/d any Railway Station.

Steel cut nails, 3-inch to 6-inch basis—

2 tons 9/3 per cwt.
4 cwt. lots 9/6 per cwt.
} d/d any Railway Station.

Slit rods (iron) £8 per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E.C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb. "BV"	0	13	6
C 20 by 10 225s. 155 ,, "Jumbo"	0	18	9
C 20 by 14 112s. 108 ,, "Lydbrook"	0	13	3
C 28 by 20 112s. 216 ,, "Lydbrook"	1	6	9
Charcoal Tinplates:			
C 20 by 14 112s 108 lb. "Allaway"	0	14	0

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

		£	s.	d	
Steel:					
Blooms	at	4	2	0	per ton.
Billets	at	4	4	0	,,
Sheet Bars	at	4	6	0	,,
Finished Steel:					
Bars	at	5	15	0	per ton.
Angles	at	5	16	0	,,
Tees	at	5	19	0	,,
Joists	at	5	0	0	,,
Fencing Standards	at	5	15	0	,,
Shoeing Bars	at	5	19	0	,,
Tyre Bars	at	5	19	0	,,
Half-Round Bars	at	6	3	0	,,
Heavy Rails	at	5	10	0	,,
Light Rails	at	5	10	0	,,

Structural Steelwork:

Prices on application

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. Dis. 1¼% & 1%	166	0	0	to	166	10	0	per ton
English Bars, f.o.b. Dis. 1¼% & 1%	167	0	0	to	167	10	0	,,
Straits G.M.B., cash Warehouse, Net	163	15	0	to	164	0	0	,,
Straits G.M.B., 3 months, Warehouse, Net	161	15	0	to	162	0	0	,,
Australian, Mt. Bischoff, Warehouse, Net	164	0	0	to	164	5	0	,,

COPPER.

Copper:	£	s.	d.		£	s	d.	
Standard G.M.B., cash Warehouse, Net	80	0	0	to	80	2	6	per ton.
Standard G.M.B., 3 months, Warehouse, Net	79	0	0	to	79	2	6	,,
English, Tough, Cake & Ingot, Warehouses, Net	85	0	0	to	85	10	0	,,
English, Best Select, Warehouse Net	86	0	0	to	86	10	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	90	0	0	to	91	0	0	,,
English, Sheets for India, f.o.b., Dis. 2½%	86	0	0	to	87	0	0	,,
Electro, Warehouse, Net	86	5	0	to	86	10	0	,,
Ore, ex. ship	0	14	9	to	0	15	9	per unit.
Regulus, Matte and Precipitate, ex ship,	0	15	9	to	0	16	3	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%	0	0	7½	per lb
Sheathing ,, ,,	0	0	7¾	,,

SPELTER.

	£	s.	d.		£	s.	d	
Silesian outports, Net	28	10	0	to	28	15	0	per ton.
Blende of 50 %, Net	8	0	0	to	8	7	6	,,
Calamine, Net	8	9	0	to	8	10	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis 2½%	17	10	0	to	17	12	6	per ton.
Spanish, ex ship, Dis. 2½%	17	7	6	to	17	8	9	,,
Lead Ore of 70 %, Net	8	10	0	to	8	15	0	,,

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½ %	55	0	0	to	56	0	0	per ton
Ore, 50 %, ex ship, Dis. 2½%	12	10	0	to	15	0	0	,,
Crude, ex ship, Dis. 2½ %	30	0	0	to	32	0	0	,,

QUICKSILVER.

	£	s.	d.	
Spanish, 75 lb., Warehouse, Net	7	5	0	per flask
Italian ,, ,, ,,	7	2	6	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.

	s.	d.
Main Coal	6	6
Best Hard Steam (hand picked, as used by the Railway Companies)	5	6
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	6	0
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston, quote as follows, per ton at pit :

Kilburn Coal :

	s.	d.
Best London Brights	9	3
Large Nuts (1½ to 3½)	9	0
Small Nuts (¾ to 1½)	6	0
Peas (⅜ to ¾)	5	0
Rough Slack	4	0
Slack	3	6
Smudge	2	0

Rutland Coal :

	s.	d.
Brights (4 to 8)	7	6
Large Nuts (2 to 4)	7	0
Slack	3	6
Hand picked Hards	7	6
Hard Cobbles	6	3

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit :—

Digby Coal :

Steam.	s.	d.
Best Hand Picked Hard	8	6
Steam Hard.	7	3
Hard Nuts	6	6

Gedling Colliery.

High Hazel (or Ashless House Coal).	s.	d.
London Brights, 4 to 8 in. cube	11	0
Bright Cobbles (Hand Picked)	10	6
Large Nuts, 2 to 4 in. cube	10	0
Small Nuts, 1 to 2 in. cube	6	3
Pea Nuts, ⅝ to 1 in. cube	5	0

Steam.—Top Hard.	s.	d.
Best Hard	8	6
Hard Steam	7	6
Cobbles	6	3

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote :

		£	s.	d.	
Acids :	Oxalic	0	0	2½	per lb.
	[illegible], Crystals	0	0	11	,,
	Tartaric at Manchester	0	0	10¾	,,

		£	s.	d.	
Acetate of Lime :	Brown at Manchester net	8	10	0	per ton
	Grey ,,	11	15	0	,,
Alumina :	Alum, Lump, loose	5	5	0	,,
	,, ,, in casks	5	7	6	,,
	,, Ground, in bags	5	15	0	,,
	Sulphate of Alumina, 14%	4	10	0	,,

		£	s.	d.	
Ammonia :	Carbonate	0	0	3⅝	per lb.
	Muriate Grey f.o.b. Liverpool	24	15	0	per ton.
	Sal-ammoniac, Lump, 1sts, del^d. U.K.	42	0	0	,,
	,, ,, 2nds, ,,	40	0	0	,,
	Sulphate f.o.b. Liverpool	12	15	0	,,
Arsenic :	Best White Powdered net	15	0	0	,,
Bleaching Powder,	35% ,,	4	7	6	,,
Borax :	British Refined Crystal ,,	13	0	0	,,

		£	s.	d.	
Coal Tar Products :					
	Benzole, 50/90 % ,,	0	0	8½	per gal
	,, 90% ,,	0	0	9	,,
	Carbolic Acid Crystals, 34/35° C. ,,	0	0	6	per lb
	,, ,, ,, 39/40° C. ,,	0	0	6¼	,,
	,, ,, Liquid, 97/99 % ,,	0	0	9	per gal.
	,, ,, Crude, 62½% at 60° F. f.o.b. ,,	0	1	10	,,
	Creosote, ordinary good liquid ,,	0	0	1¾	,,
	Naphtha, Crude, 20 % at 120° C. ,,	0	0	4	,,
	,, Solvent, 90% at 160° C. f.o.b ,,	0	1	0	,,
	,, ,, 95 % at 160° C. ,, ,,	0	1	0½	,,
	,, ,, 90 % at 190° C. ,, ,,	0	1	1½	,,
	,, Rectified, flash point over 73° F. f.o.b. ,,	0	1	1½	,,
	,, Rectified, flash point over 100° F. f.o.b. ,,	0	1	2½	,,
	Naphthalene, all qualities				
	Pitch f.a.s. Manchester. ,,	1	12	6	per ton.
Copperas :	Green, in bulk ,,	0	12	6	,,
	,, barrels f.o.b. L'pool ,,	1	18	6	,,
	Cake ,,	1	1	6	,,
Copper :	Sulphate	24	10	0	,,

		£	s.	d.	
Cyanides :	98% minimum f.o.b. net	0	0	8½	per lb.

		£	s.	d.	
Lead :	Acetate (Sugar) White, English	28	0	0	per ton.
	,, ,, ,, Foreign c.i.f. U.K	25	5	0	,,
	,, ,, Grey	23	10	0	,,
	,, ,, Brown at Manchester	19	10	0	,,
	Nitrate	26	10	0	,,
	Litharge, Flake	18	10	0	,,
	,, Powder	19	0	0	,,
	Red Lead, Genuine, c.i.f London less 5%	19	0	0	,,
	White ,, ,, Dry ,, ,, ,,	20	0	0	,,

		£	s.	d.	
Naphtha (Wood) :	Miscible, 60 o.p.	0	2	4	per gal.
	Solvent	0	2	7	,,

		£	s.	d.	
Potash :	Bichromate... delivered England	0	0	3	per lb.
	Carbonate, 90/92 % c.i.f Hull	17	15	0	per ton.
	Caustic, 75/80 % ,, ,,	19	5	0	,,
	Chlorate net	0	0	3¼	per lb.
	Montreal in Store, Liverpool	31	10	0	per ton.
	Prussiate Yellow net	0	0	4½	per lb.

	£	s.	d.	
Soda : Ash, Caustic, 48 % ... Ordinary .. net	5	5	0	per ton.
,, ,, ,, Refined...... ,,	6	5	0	,,
,, Carbonated, 48 % .... ,,	5	10	0	,,
,, ,, 58 % (Ammonia Alkali ... .net	4	10	0	,,
,, Bleachers' Refined Caustic 50/52 % .... net	6	10	0	,,
Caustic, White, 77 %................ ,,	10	12	6	,,
,, ,, 70 % .... ,,	9	12	6	,,
,, ,, 60 % ... . ,,	8	12	6	,,
,, Cream, 60 %...... .... ,,	8	10	0	,,
Crystals, in bags	3	0	0	,,
,, barrels	3	7	6	,,
Acetate .... c.i.f. Hull net	16	15	0	,,
Bicarbonate, in 1 cwt. kegs............	6	15	0	,,
Bichromate......delivered England...	0	0	2¼	per lb.
Chlorate .... net	0	0	3¼	per lb.
Nitrate...ex quay Liverpool, ... ,,	11	0	0	per ton.
Phosphate	9	5	0	,,
Prussiate ....net	0	0	$3\frac{7}{16}$	per lb.
Silicate, Solution, 140° Tw.	4	10	0	per ton.
Sulphate (Glauber Salts)...............	1	10	0	,,
,, (Saltcake, 95%)...............	1	15	0	,,
Sulphur : Recovered	4	15	0	,,
Roll	6	15	0	,,
Flowers.	7	10	0	,,
Zinc : Sulphate	6	15	0	,,
Shellac : Standard TN orange spot	9	10	0	per cwt.

MINERALS.

Messrs. S. W. Royse and Co., quote :—

	£	s.	d.	
Barytes : Lump Carbonate, 90/92%	3	10	0	per ton.
Sulphate, No. 1, White	2	15	0	,,

China Clay : of various qualities for all purposes ; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall : stocks also kept at Runcorn and Preston. Quotations given carriage paid.

	£	s.	d.	
Chrome Ore : Basis 50% c.i.f. British Ports...........	3	10	0	,,
Manganese : Lump c.i.f. Liverpool 10¼d.	per metallic unit.			
Ochre : French JC .... f.o.b. Rouen, net	2	5	0	per ton.
,, JF	5	10	0	,,
Talc : (French Chalk).........c.i.f. Liverpool	3	10	0	,,

Messrs. Henry Bath and Son, quote :—

	£	s.	d.		£	s.	d.	
Copper, Ores of, 10 to 25%	0	13	3	to	0	14	3	per unit.
Regulus, 45 to 55%	0	14	3	to	0	14	9	,,
Precipitate, 65 to 80% ...	0	14	4½	to	0	14	10½	,,
Tin Ores, 70 %...............	95	0	0	to	97	0	0	per ton.
Lead Ore, 70%					[illegible]	0	0	,,
Blende, 50%					8	6	6	,,
Calamine....					8	9	0	,,
Antimony, Star Regulus	48	0	0	to	50	0	0	,,
,, Ore 50%	12	10	0	to	15	0	0	,,

Messrs. Barrington and Holt, Cartagena, quote :—

Iron Ore

			s.	d.	
Ord. 50%, ...	f.o.b.	Porman	7	8	per ton.
Do.	,,	Cartagena	8	0	,,
Special low phos.	,,	Porman			
Do. do.	,,	Cartagena............	8	2	,,
Extra quality do.	,,	,, ...	8	6	,,
Special Iron Ore	,,	,, ...	nominal		,,
Specular 58% do.		....	11	0	,,
S.P. Campanil Coast	,,	....	9	6	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote :—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	3
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Port Pine...............	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	3
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	0
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	4	0
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do	,,	11	10	0		13	0	0
St. John, Miramichi, etc., Spruce	,,	7	10	0		7	15	0
Nova Scotia Spruce..	,,	7	7	6		7	12	6
Spruce Boards................	,,	6	7	6		6	12	6

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	1	0		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak..............	per load	12	0	0		19	0	0
Greenheart.....	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s	d
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak	,,	0	2	6		0	3	0
Norway Spars................	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality	per std.	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ,, ...	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		16	0	0
Wyburg	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	,,	11	0	0		16	0	0

SELECTED PATENTS.

NEW PATENTS APPLIED FOR.

(November 27th—December 2nd.)

INTERNAL COMBUSTION ENGINES, ETC.

[illegible]. J. A. P[illegible], J. M[illegible] and C. E. Mow[illegible], London.—Improvements in gas engines or the like.

[illegible]. A. [illegible], London.—Improvements in multicylinder internal combustion engines.

24,624. H. R. Rignold, Liverpool.—Improvements in and connected with carburetters for internal combustion engines.

[illegible]. G. H. H. Freeman and A. [illegible], London.—Improvements in internal combustion engines.

24,715. H. Duffield, London.—Improvements relating to the generation of power in explosion engines.

24,722. A. E. Shiner, London.—Improvements in silencers for internal combustion engines.

24,865. A. Winton, London.—Improvements in vertical explosive engines.

24,914. R. W. H. Rodney, Birmingham.—Improvements in or relating to oil engines.

[illegible]. E. D. [illegible], London.—An improved method of starting explosion engines.

24,940. J. H. Ladd, London.—Improvements in and relating to gas furnaces and to a method of working the same.

24,953. M. Girola, London.—Improvements in internal combustion engines.

25,053. L. Renault, London.—Improvements relating to apparatus for effecting the starting of explosion motors.

FURNACES, ETC.

24,473. J. K. Broadbent, Manchester.—Improvements in apparatus for preventing smoke and regulating the supply of air to furnaces.

24,497. R. H. Parker and H. Baker, London.—Improved furnace bar.

24,566. E. Brunner, Manchester.—Improvements in furnaces.

[illegible]. J. S. S. Fulton, London.—Improvements in and relating to automatic stokers.

24,620. J. S. S. Fulton, London.—Improvements in and relating to smoke-consuming furnaces.

24,755. E. Efran, London.—Method of and apparatus for controlling the supply of the combustion air to the fuel in furnaces.

DRIVING MECHANISM, ETC.

[illegible]. A. H. Mayes, Hassocks, Sussex.—An automatic tension device for driving bands.

24,635. J. T. Ford, London.—Improvements in driving belts or bands.

24,799. P. Kugel, London.—An improved stuffing box for a rotating shaft.

24,854. The Warwick Machinery Company, Ltd., London.—Improvements in and relating to packings for rotating shafts. (The General Electric Company, United States.)

[illegible] W[illegible] and A. P[illegible], Birmingham.—Improvements in bearings for shafts and the like.

[illegible] and W. Doran, London.—Improvements in differential or compensating driving gear for traction engines and other motor vehicles.

25,065. A. W. Prentice and A. Shiels, London.—Improvements in or relating to driving mechanism.

GAS PRODUCERS, ETC.

24,443. T. W. S. Hutchins and J. B. Wilkie, Manchester.—Improvements in the construction and working of gas producer apparatus.

24,503. The Otto Hilgenstock Coke-Oven Company, Ltd., London.—An improvement in carbonising coal for increasing the yield of ammonia.

24,678. H. Bowman and J. T. Southworth, Manchester.—Improvements in feeding appliances for produer or water-gas generators, blast furnaces and the like.

24,786. J. Wilkinson, Leeds.—Improvements in producing and in utilising mixtures of coal gas and air for lighting, heating and power purposes, and in apparatus therefor.

24,838. W. Saward and J. Astley, London.—Improvements in connection with fittings for gas producers;

25,045. G. A. Heckert, London.—Improvements relating to the introduction of steam or gas into a gas retort.

ELECTRICAL.

24,518. C. P. A. Dahl, London.—Self-generating steam or hot-air power electric machine.

24,718. Ferdinando Lori, London.—Improvements in or relating to wireless telegraphy.

24,721. F. H. Rogers, London.—Improvements in insulators.

24,729. C. W. Atkinson, London.—Improvements in and relating to electric controllers.

24,785. V. Mitkevitch, Liverpool.—An improvement in the production of the electric arc for scientific and industrial purposes.

24,794. H. W. Wilson, c.o. The East Anglian Engineering Company, Ltd., Stowmarket.—Improvements in brush-holders for electrical machines.

24,809. A. Parravano, London.—An improved stem of syntonic radio telegraphy.

24,855. The British Thomson-Houston Company, Ltd., London.—Improvements in and relating to electric resistances.

24,856. The British Thomson-Houston Company, Ltd., London.—Improvements in and relating to vapour electric apparatus.

24,87[illegible]. A. F. Hills, D. Urquhart, and A. E. Honey, London.—Improvements in dynamo electric machines.

24,943. M. R. De Malval, London.—Improvements in telephonic and other electrical apparatus.

25,047. Sir O. J. Lodge, A. Muirhead, and E. E. Robinson, London.—Improvements in, and relating to vapour electric apparatus or devices.

25,058. The Land- und Seekabelwerke Akt.-Ges., Liverpool.—Improvements in and connected with the insulation of electric cables.

WHEELS.

[illegible] London.—Improvements in or relating to tyres for wheeled vehicles to travel on roads.

[illegible] London.—Improvements in the manufacture of wooden wheel-rims.

[illegible] M. Albrecht, London.—Improvements in the construction of wheels for vehicles.

24,531. M. Albrecht, London.—Improvements in the construction of wheels for vehicles.

24,554. F. S. Biram, Liverpool.—Improvements [illegible]

24,632. M. G. Babio, London.—Improvements in vehicle wheels.

24,650. C. R. Garrard and C. G. Garrard, London. Improvements in spring wheels for vehicles.

24,731. A. G. Ramage, London.—Improvements in spring wheels.

24,[illegible]. G. Hattersley and Sons Ltd., and C. Korte, Keighley.—Improvements in wheels for traction engines, motor-cars and like road vehicles.

24,893. J. W. Boulton, Chester.—Wheels for road vehicles, motor-cars, steam wagons, and traction engines.

24,965. J. Slee, Liverpool.—Improvements in or connected with resilient wheels.

25,026. J. W. Wedderburn, W. A. Webber, and W. H. Wedderburn, East Ham, Essex.—A new and improved wheel for vehicles.

STEAM APPLIANCES, PUMPS, LUBRICATORS, ETC.

24,444. H. G. Atkinson, Birmingham.—Improvements in hand air-pumps.

24,460. D. A. Quiggin, Liverpool.—Improvements in apparatus for condensing steam and heating water.

24,476. J. Crichton and J. Macdonald and Son, Ltd., Glasgow.—Improvements in lubricating devices for tools, operated by air, steam, or gas.

24,524. D. McGill, London.—Improvements in and connected with the packing and lubricating of pistons and piston rods.

24,537. A. Szanto, London.—Improvements in and connected with forced lubricating and pumps therefor.

24,587. W. H. Longsdorf and F. E. Jordan, London.—Improvements in and relating to steam superheaters.

24,669. R. A. Fletcher and S. H. Sershall, Birmingham.—An improved lubricator.

24,690. J. H. Ramsbottom. Manchester.—Improvements in the construction of air-pumps for condensing steam engines.

24,751. H. Liechty, London.—Improvements in locomotives.

24,808. S. S. Younghusband, London.—Improvements in or relating to the smoke-boxes of locomotive engine and similar boilers.

24,941. G. Conroy, London.—Improvements in pumps.

TURBINES.

[illegible] N. Prosper, Marquis de Chasseloup-Laubat, London.—Improvements in turbines.

24,670. L. Wilson, Greenock.—Improvements in applying turbines to locomotives.

24,972. The Warwick Machinery Company, Ltd., London.—Improvements in and relating to elastic fluid turbines. (The General Electric Company, United States).

25,049. E. A. F. de Retz, London.—Improvements relating to explosion turbines.

MINING.

24,486. N. V. Hybinette, London.—Process of refining copper nickel matte.

24,511. E. R. Foley, London.—Improved safety appliance for mine cages, lifts and the like.

24,570. H. P. Moorley, Sheffield.—Improvements in and relating to rock-boring machines.

24,590. G. Dunkelberg, London.—Improvements in or relating to miners' cages, lifts and the like.

24,666. T. H. Alexander, Rhondda.—Improvements in and relating to miners' drinking tins and the like.

24,900. J. McCutcheon, Glasgow.—Improvements in and relating to apparatus for detecting the presence and volume of firedamp (methane), or other light gas or gases in mines or other places.

IRON AND STEEL.

24,655. T. Kalinowsky, London.—Process for disintegrating basic slag.

24,885. P. R. Peiseler, Barmen, Germany.—Improvements in forging hammers.

24,958. G. C. Marks, London.—Improvements in armour-plates.

25,004. S. N. Brayshaw. Manchester.—Improvements in the process of hardening steel.

25,033. Davy Bros., Ltd., and E. Crowe, London.—Improvements in controlling gear for reversing rolling-mill engines.

MACHINE TOOLS, ETC.

24,464. F. R. Bradley, London.—Improvements in lathe chucks.

24,555. W. Rowland, Liverpool.—Improvements in machinery for making tubular or hollow bodies, partly applicable to forging metal.

24,616. H. M. Duncan and H. Pierpont, London.—Improvements in or relating to automatic actuating mechanism in drilling or like machines.

24,659. C. J. Dalley, D. Granetz, and W. F. Peebles, London.—Improvements in turning lathes.

24,692. G. F. Pinhey, Plymouth.—An improved milling and grinding appliance.

24,769. A. Kenrick, jun., Birmingham.—Improvements in the mode of and means for cutting spur gear.

24,779. A. Cook and J. Harvey, Glasgow.—Improvements in and connected with saw-sharpening machines.

24,784. W. G. Bungeroth and W. Tyrer, Liverpool.—Improvements in mechanisms for effecting or controlling the actions of tools of lathes, milling and profiling and similar machines.

25,036. A. Ransome and W. T. Jones, London.—Improvements in planing and other machines having reciprocating cutters.

25,071. H. Sack, London. — Improvements in hydraulic shears.

PIPES, CONDUITS, ETC.

24,461. H. E. Routledge, Manchester.—Improvements in or in connection with drain, and sewer, water, and other pipes, and electric conduits.

24,687. D. Macfie, Edinburgh.—Improved ball joint for pipes and tubes.

24,742. F. W. Rief, London.—Improvements in spigot-and-socket joints for pipes.

25,000. J. C. Sellars, Birkenehad.—Improvements in means for conveying air or other gases.

MARINE.

24,455. J. W. [illegible] and W. A. H[illegible], Manchester.—Improvements applicable in connection with the valves of steam and like engines.

24,474. F. A. Stevens, Southampton.—New or improved boats' davits.

24,685. R. Pattison, Glasgow.—Improvements in and relating to applicances for supplying air to submarine vessels.

24,704. W. H. Dobson, London.—Improvements in jet propellers for propelling sea-going vessels and for raising, supporting and propelling aerial vessels.

24,735. F. W. Howorth, London.—Improvements in light buoys and similar light-signal-apparatus. (Aktiebolaget Gasaccumulator, Sweden.)

24,850. J. G. Cockburn, London.—Improvements in or relating to switches or controllers for electric motors for ships' steering gear, hoists and the like.

24,880. J. W. Mowbray, London.—Improvements in governors for marine engines.

MISCELLANEOUS.

24,445. F. C. Lyster, Birmingham.—Improvements in automatic weighing machines.

24,462. H. Pooley and Son, Ltd., C. Gowing, and A. Harris, Liverpool.—Improvements in or connected with weighing machines.

24,504. W. Beimann, London.—Improvements in charging coke ovens with compressed coal.

24,525. J. R. Temperley, J. Temperley, and W. Alexander, London.—Improvements in and relating to cable transporters.

24,526. E. Coignet, London.—Improvements in and relating to reinforced concrete structures.

24,535. J. J. Harrod, London.—Improvements in or relating to metallic piles.

24,538. F. W. Howorth, London.—Improvements in electrodes for electrolytic apparatus.

24,577. F. D. W[illegible], London.—Cylinder with arrangement of pistons within for more directly utilising the applied force.

24,[illegible]. H. M. D[illegible] and Frank Hinman Pierpont, London.—An improved measuring instrument.

24,[illegible]. G. O. H. K[illegible], London.—Improvements in cocks or taps.

24,640. H. J. Haddan, London.—Improvements in valves. (The Nichols Manufacturing Company, United States.)

RECENT SPECIFICATION.

IMPROVEMENTS IN VAPORISERS FOR INTERNAL COMBUSTION ENGINES.

J. N. Paxman, Colchester (Davey, Paxman and Company; Ltd. Accepted November 2nd 1905.—This invention relates to vaporisers for internal combustion engines using heavy liquid hydrocarbon of the type having an annular chamber surrounding and surrounded by a heated chamber, and it consists of the combination with such an apparatus of a supplemental vaporiser heated by a lamp and of certain details of construction hereinafter more particularly described.

The improved apparatus consists essentially of a chamber A to receive the exhaust gases having a flanged opening *a* at one end by which the exhaust is admitted, a flanged opening a^1 at the bottom by which the exhaust gases escape, and an opening at the top having a flanged opening which is closed by an inspection cover a^2. In this chamber is an opens ended cylinder B having ports C, C^1 at opposite end thereof. In this cylinder is inserted a liner D which is secured to the said cylinder at one end and has a ground valve or faced seating at the other end, so that it can be readily removed for cleaning or inspection The size of this liner is such that there is an annular space between the liner and the cylinder which forms the vaporising chamber

The liquid hydrocarbon is introduced into the vaporiser mixed with a certain proportion of air. The hydrocarbon is admitted into the port or passage E through any convenient form of valve whereby the amount may be varied, and in the passage E is an air inlet valve F, the port of which is provided with an apron G which causes the air passing through the valve to be drawn over the hot surface of the vaporiser, thus seating it.

The surface of the port C^1 is preferably provided with ribs or fins *c* to increase its effective heating surface.

The pipe or tube H by which the vapour passes from the vaporiser to the engine is provided with a jacket J for a portion of its length, the said jacket having a lining of asbestos or other refractory material (not shown in the drawings). This jacket J has a vertical opening *j* on one side so arranged that the flame from a blow lamp—for which a suitable holder K is provided—can play through the said opening on to the vapour tube H, thus forming the auxiliary vaporiser which can be used at will.

Fig. 1

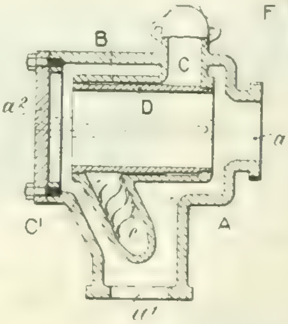


Fig. 2

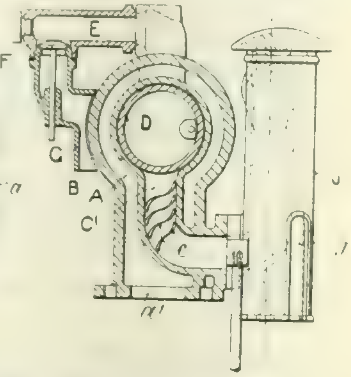


Fig. 3

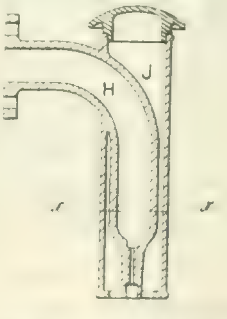
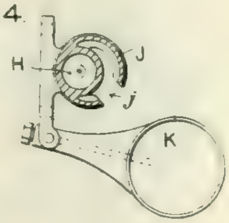


Fig 4



NEW PUBLICATIONS.

"HANDBOOK OF METALLURGY."

By Dr. Carl Schnabel. Translated by Henry Louis, M.A. Second edition. Vol. I. Macmillan and Co. 25s. net.

A generally recognised drawback to many of the English metallurgical works is that, although excellent in their way, they are too restricted in their scope to meet the requirements of those who desire a work which will give them a comprehensive statement of the subject. The majority of English writers have contented themselves by merely expounding the mysteries of individual metals, but Dr. Schnabel, the eminent German metallurgist, has designed and completed a treatise the aim of which is to give an exhaustive account of the metallurgical treatment of all the metals ordinarily employed (iron excepted), together with the recent improvements in the science. At the same time the scientific principles underlying each process are dealt with and illustrated by examples drawn from actual practice in various parts of the world. About seven years have elapsed since the first English edition was published, and during that time the work has secured for itself a permanent place among standard technical works. This new edition includes as far as possible all the advances that have been made in metallurgy since the work was first published, and in some instances Professor Louis has incorporated concise notices of processes which have been introduced since the production of the German original. The work is divided into two volumes, the first of which deals with the metallurgy of copper, lead, silver, and gold; while the second volume will embrace the remaining metals. It would be impossible, with the space at our disposal, to give an adequate *résumé* of the contents of this work, which is well illustrated and may be warmly recommended. To those familiar with the German edition, it is evident that the translator has accomplished his arduous task in a manner worthy of himself.

"THE APPLICATION OF ELECTRIC MOTORS TO MACHINE-DRIVING."

By Andrew Stewart, A.M.I.E.E. Third edition, revised and enlarged. S. Rentell and Co. Ltd. 2s.

The object of this well-illustrated little work is to illustrate the various applications of electric motors in our leading industries, and to indicate the advantages consequent upon their extensive adoption. The following is a brief synopsis of the contents: The electric motor; motor starters and regulators; why electricity pays; the small gas engine *versus* the electric motor; electricity in iron and steel works; electric power in shipbuilding and engineering works; the application of electric motors to printing machinery; electric power in textile finishing and paper factories; electric cranes and lifts; miscellaneous applications of electric motors; and electricity tariffs.

BOOKS RECEIVED.

"Telegraphy: a detailed exposition of the Telegraph System of the British Post Office." By T. E. Herbert, A.M.Inst.C.E. Whittaker and Co. 6s. 6d. net.

"The Practical Telephone Handbook, and Guide to the Telephonic Exchange." By Joseph Poole, A.I.E.E. Whittaker and Co. 6s. net.

"Alternating Currents, their Theory, Generation, and Transformation." By Alfred Hay, D.Sc., M.I.E.E. Harper and Brothers. [illegible] net.

CATALOGUES, ETC.

The subject chosen for the handsome calendar issued this year by the United States Metallic Packing Company, Ltd., Soho Works, Bradford, etc., is "Progress," represented as a draped figure by Alfred David Lenz. This is rendered in grey bas-relief, the calendar below is printed prominently in white. The firm's telegraphic addresses and numbers are also given.

E. Green and Son, Ltd., Wakefield.—We have received a copy of the new edition of the firm's well arranged and beautifully printed and illustrated booklet on the subject of Green's Improved Patent Fuel Economiser, which, as our readers are aware, heats the feed water for steam boilers to a high temperature from the waste heat in flue gases. It is pointed out that "the boiler power is thus augmented, a uniform and easy rate of steaming being maintained. In addition there is a large reserve of hot water, ranging from 200 deg. to 300 deg. F., always available for any special demand the plant may be required to deal with at short notice. This latter point refers especially to electric light and power stations, where the load is variable, and there is frequently a sudden call for extra power. It applies equally to dye works, paper mills, bleach works, woolcombers, steam laundries, breweries, etc., and in fact wherever a large quantity of hot water is a necessity. Heating the feed water by means of an economiser is not only a direct advantage on account of the saving of fuel, but is also indirectly of great benefit to the boilers by preventing the damage from unequal expansion and contraction, which always occurs when the feed is introduced cold. Where the feed water is impure the sediment is deposited in the bottom boxes of the apparatus, from whence it can be more easily removed than from the boiler."

The General Electric Company, Ltd.—A catalogue which has the distinction of being the largest and heaviest we remember handling, includes the complete output of the General Electric Company. It turns the scale at 9 lb. 6 oz. In a publication of such dimensions, considerable attention has very properly been given to indexing and to the provision of external mechanical devices for arriving quickly at any particular section required. The sections bound up in this volume can also be had separately. They are as follows: P, "Witton" motors and dynamos, combined plant, electric cranes, boilers, engines, etc.; X, switchboards and switchboard equipments; S, branch switches and cut-outs, electric light supplies and "Robertson" lamps, "Osmi" lamps, "Nernst" lamps, etc.; M, measuring instruments, resistances, and testing apparatus; E, engineering supplies, fans, small motors, starters, electric pumps, drilling machines, arc lamps, and traction engines, etc.; H, electrical heating and cooking apparatus; F and G, fittings and glassware of every description for electric lighting; W, wires and cables, insulators, and wiremen's tools, etc.; C, "Union" steel conduits, "papristeel" insulated conduits, and accessories; L, bells, indicators, and batteries, etc.; K, telephones and fire alarms; O, motor-car accessories, electro-medical apparatus.

Worthington Pump Company, Ltd., 153, Queen Victoria Street, E.C.—A new pamphlet has been issued (No. 107) dealing with Worthington Oil Separators.

PAGE'S WEEKLY Miscellaneous

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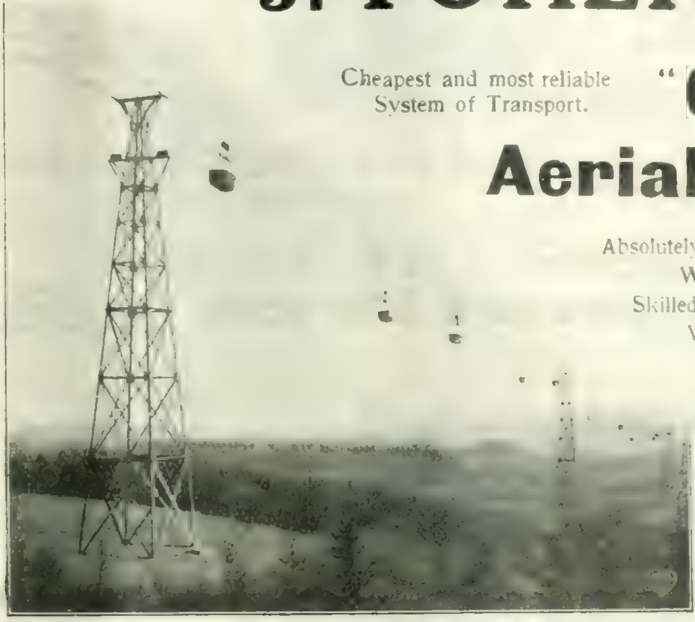

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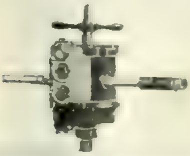

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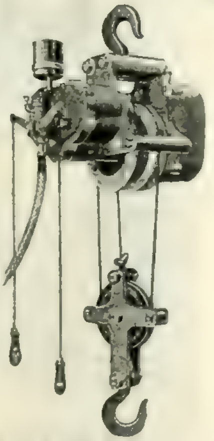

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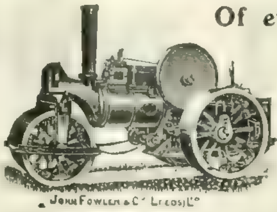
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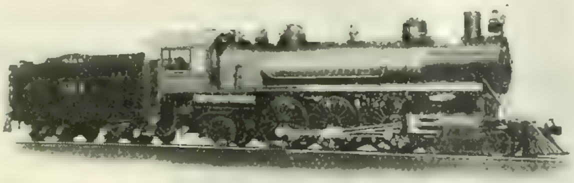

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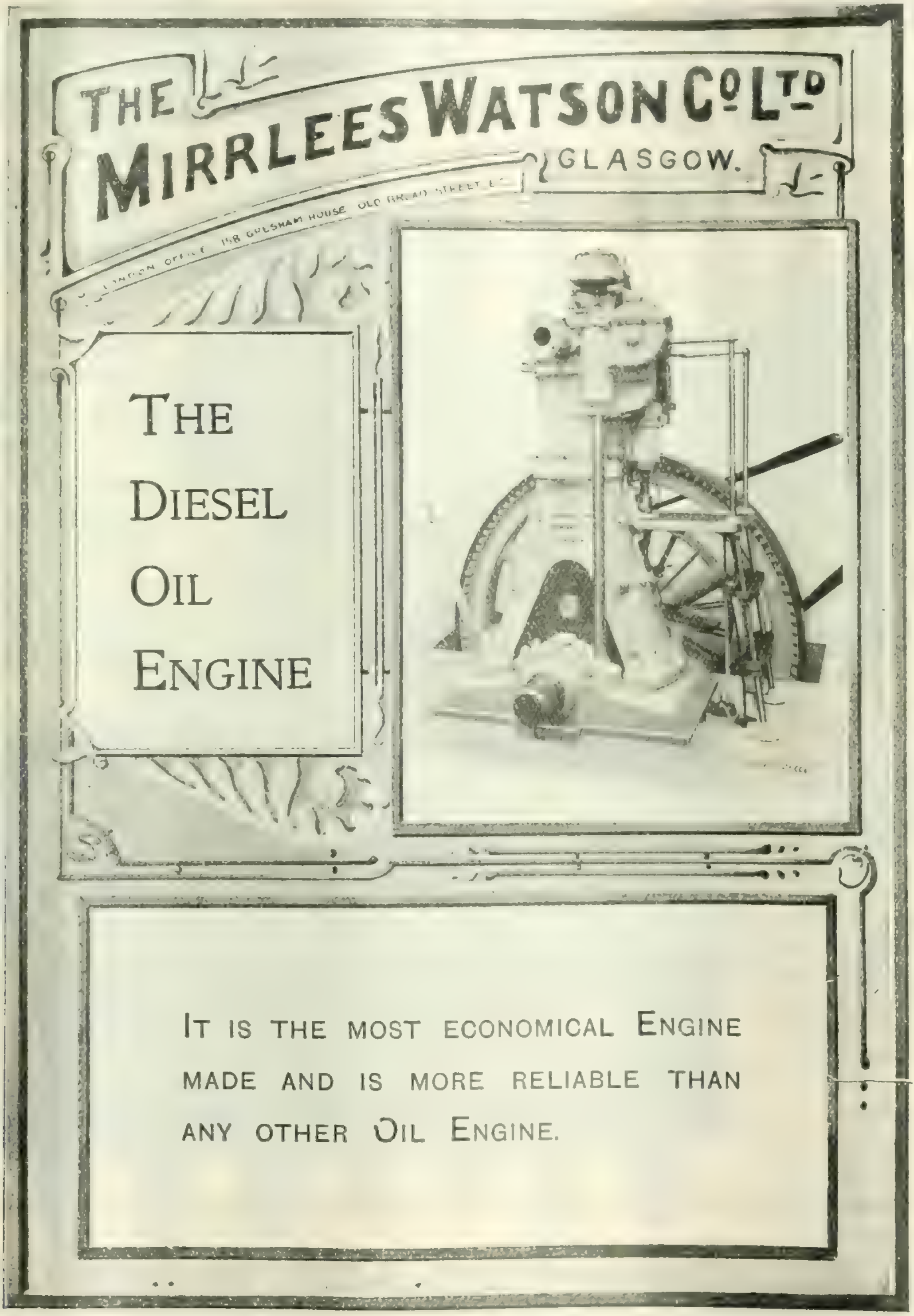

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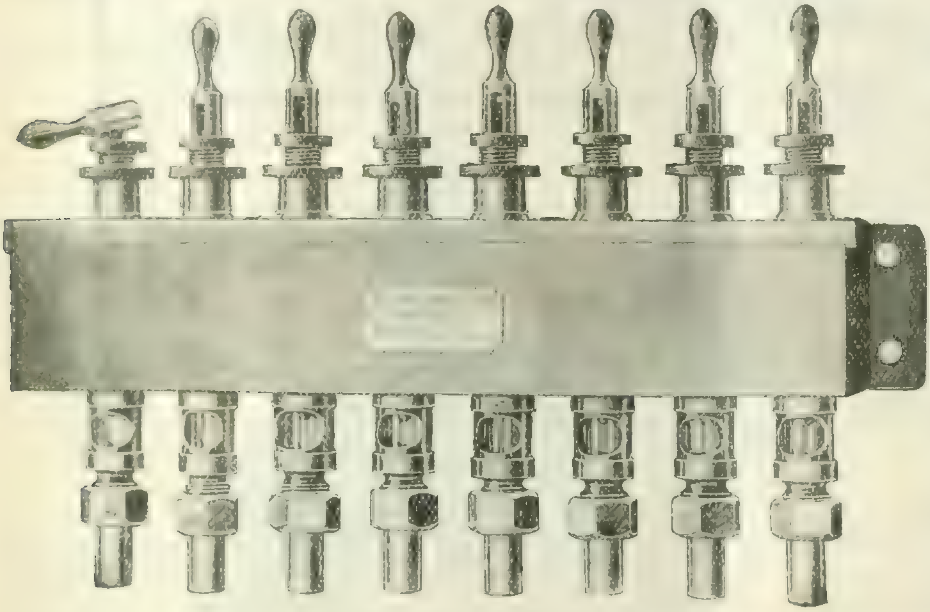

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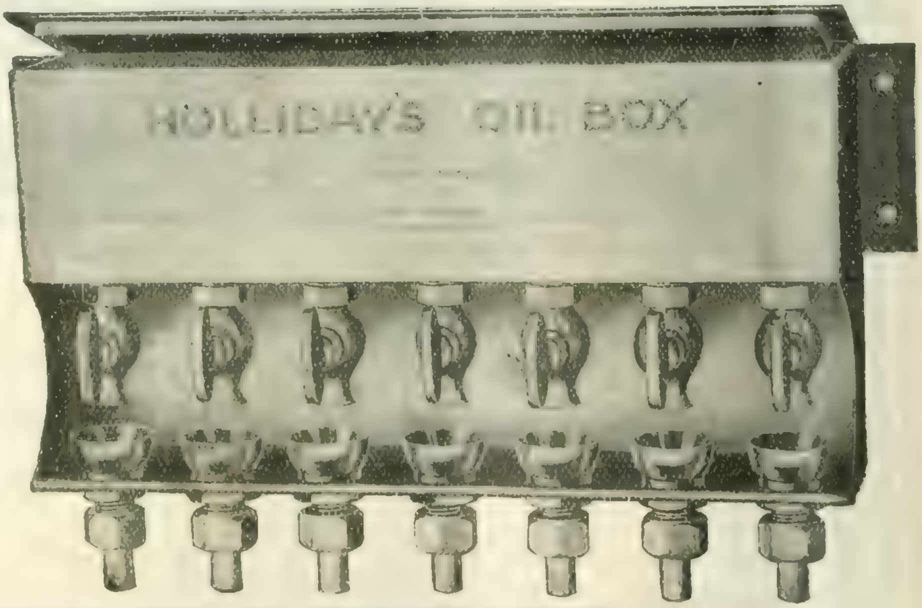

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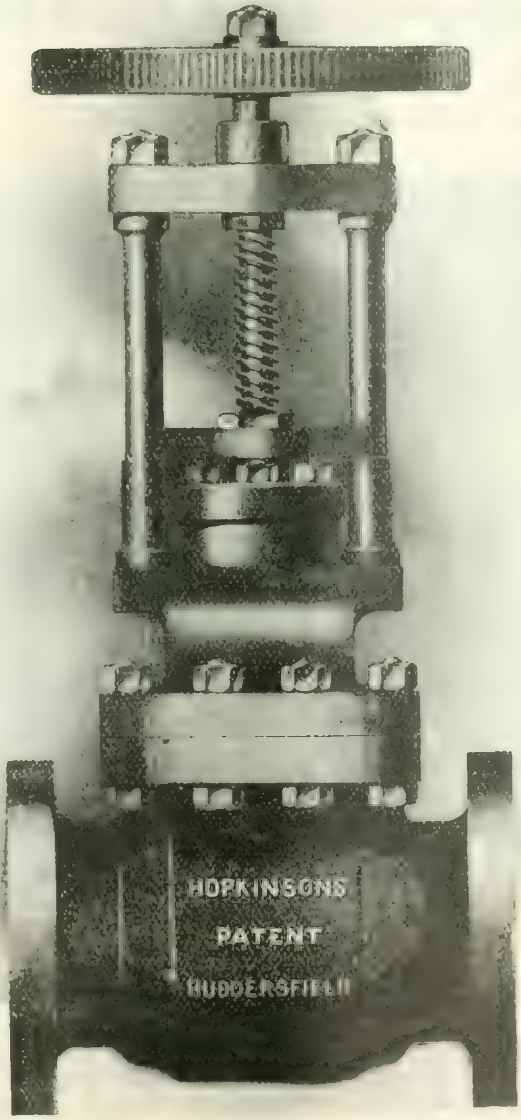

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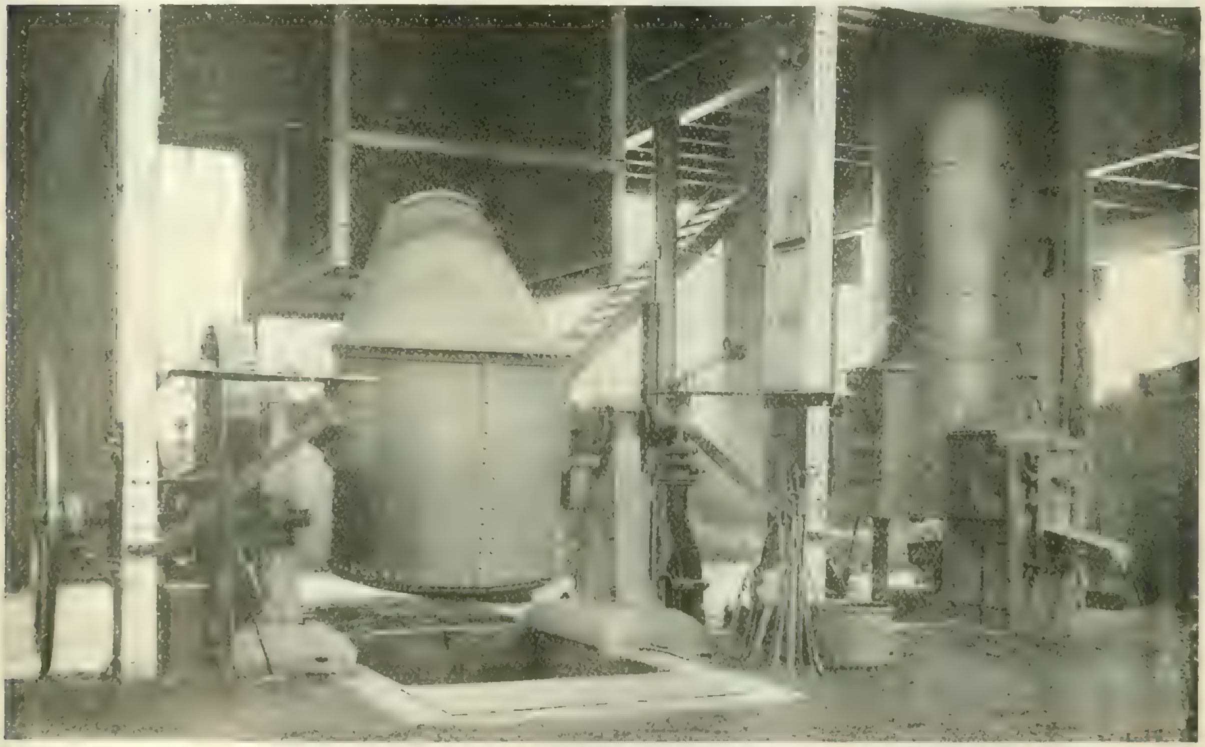

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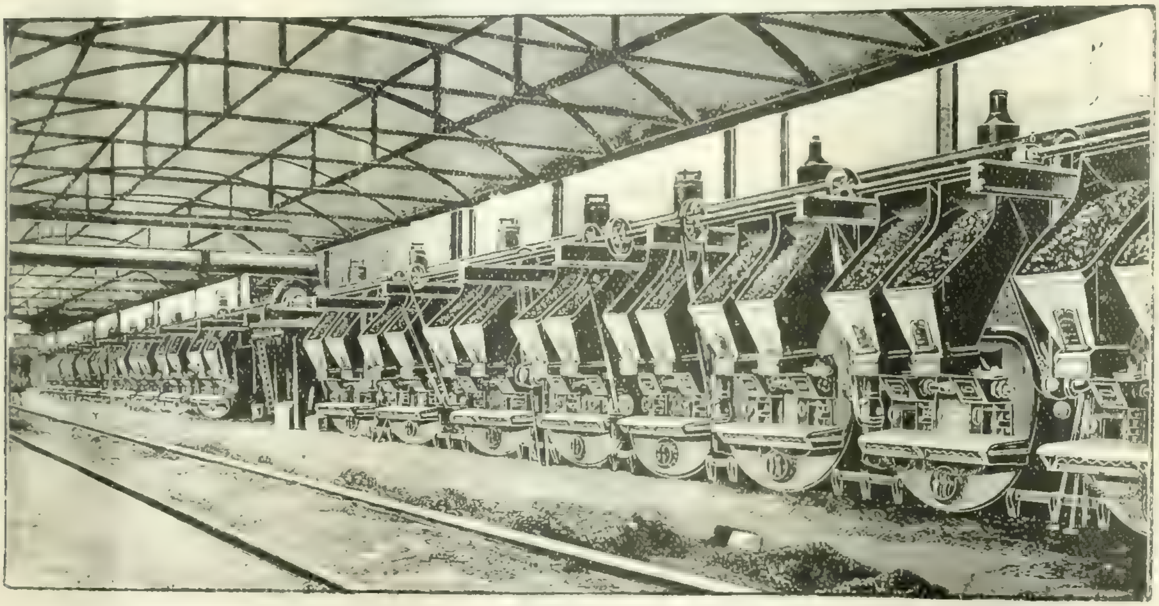

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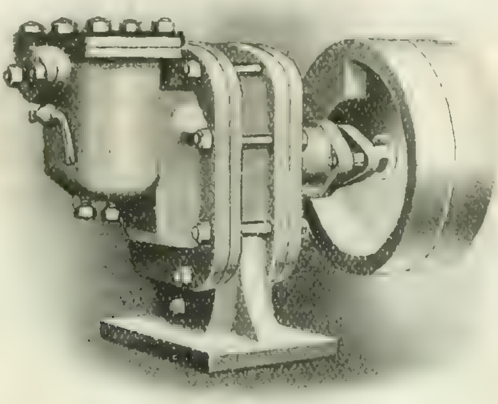

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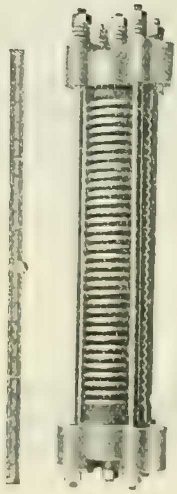

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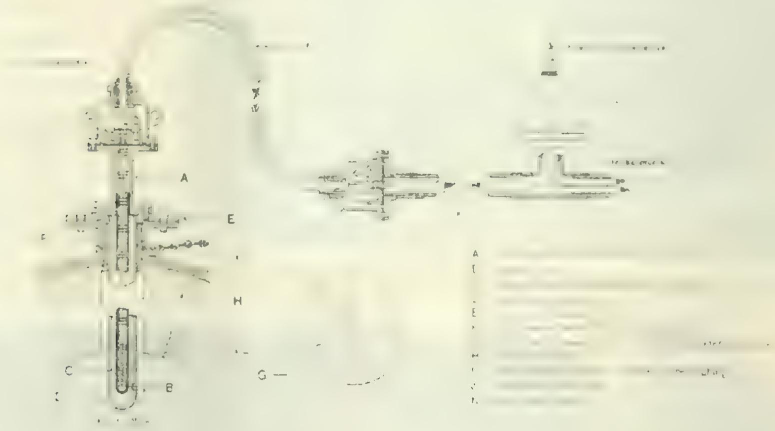

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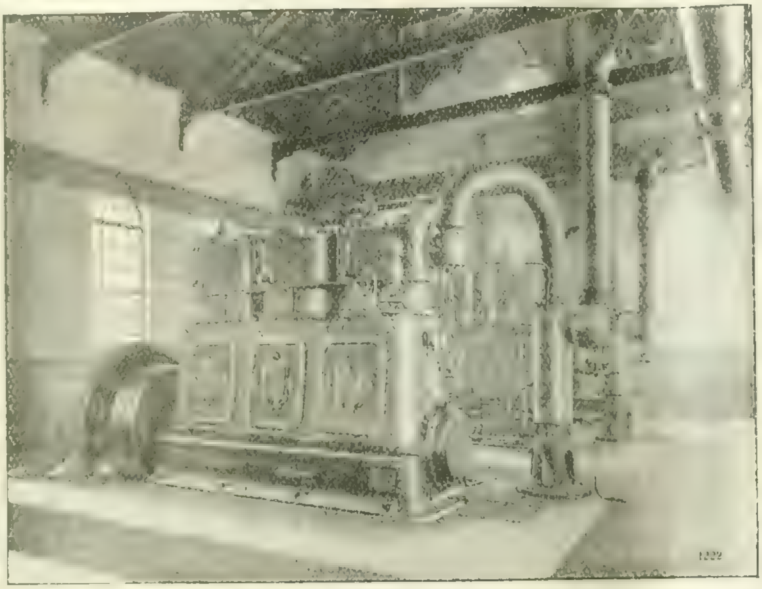

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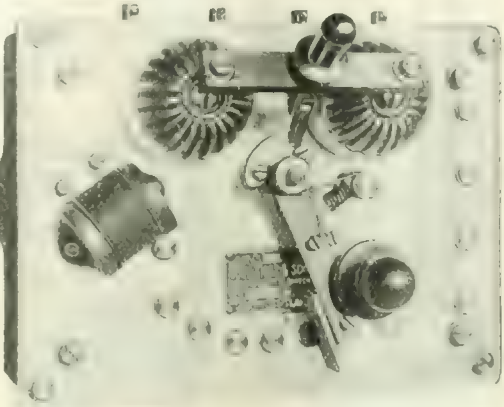

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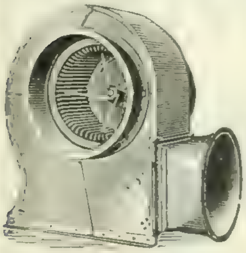

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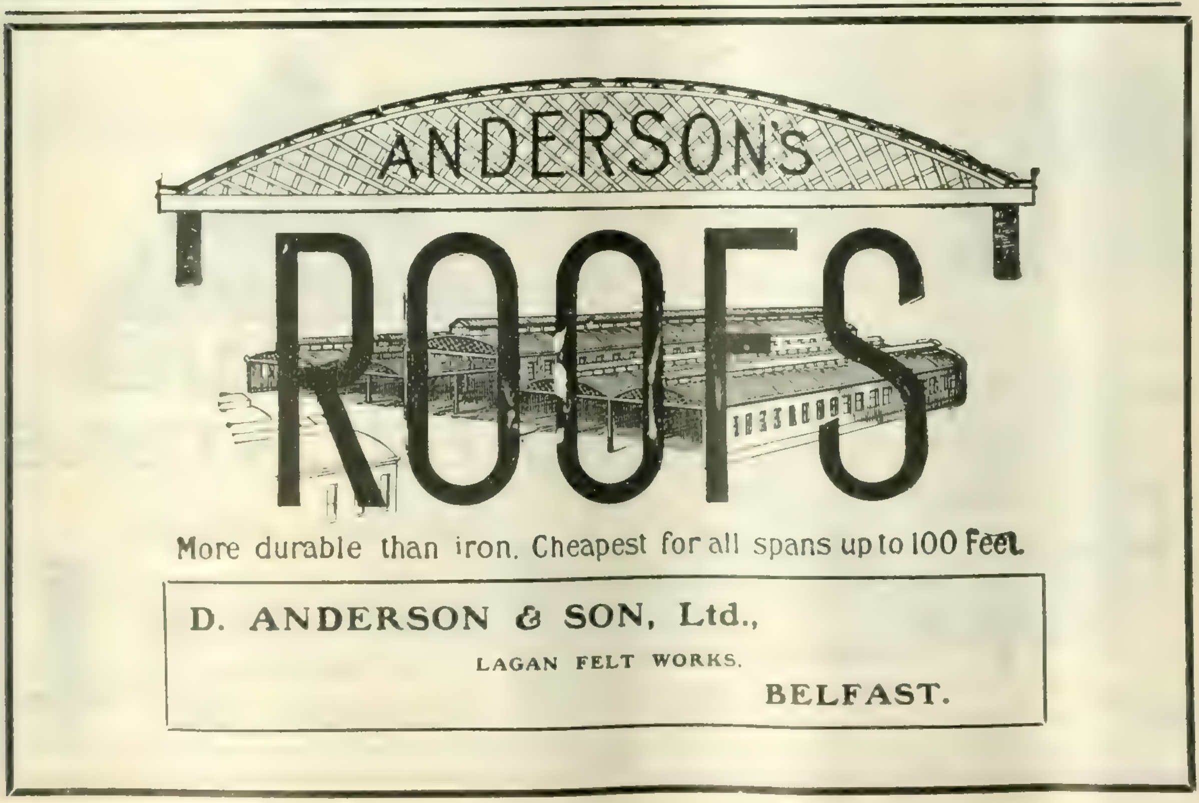

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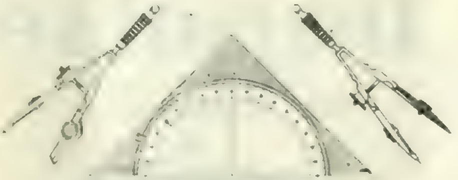

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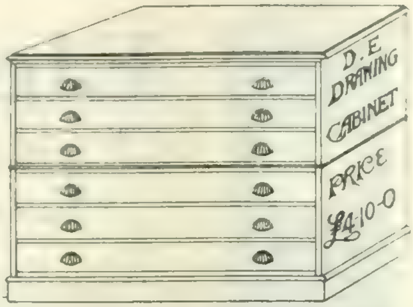

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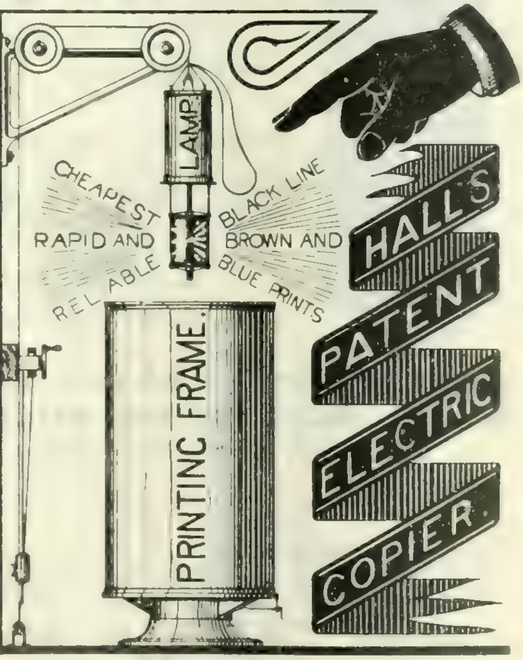

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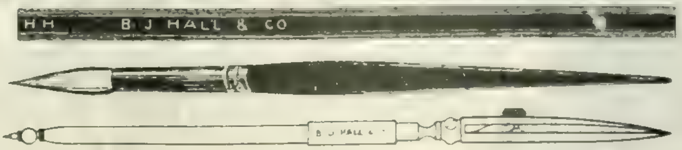
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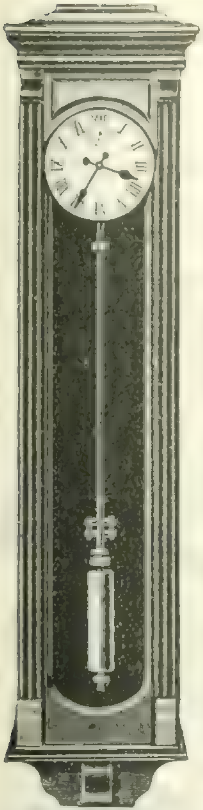

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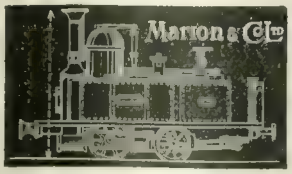

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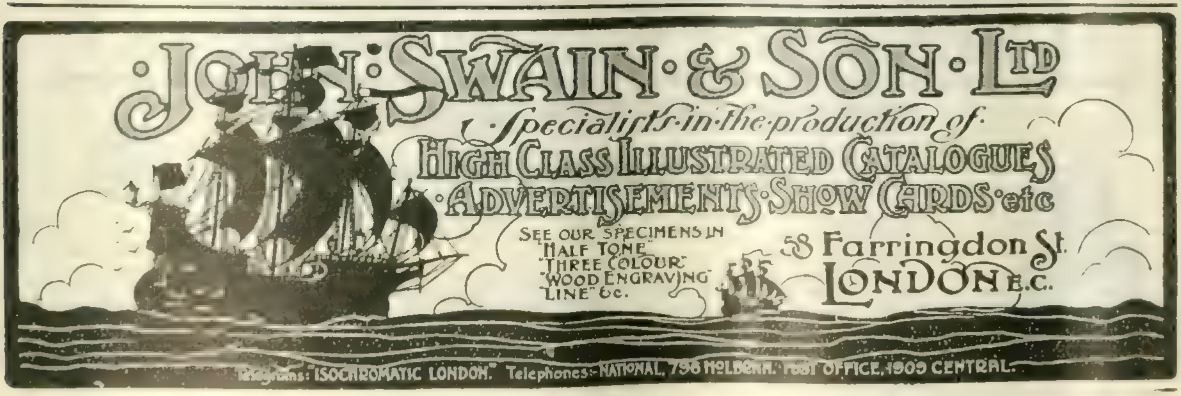

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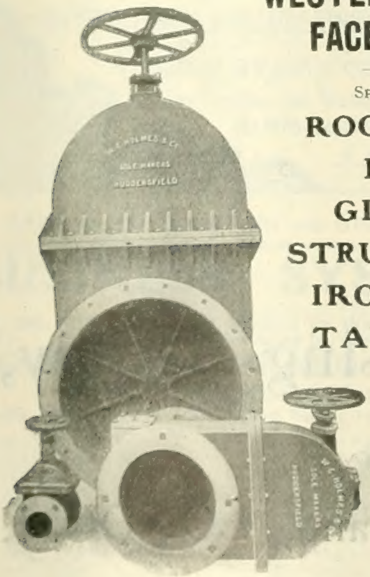

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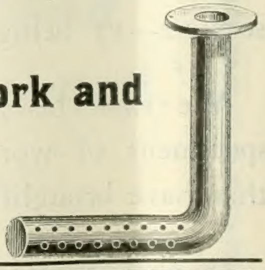

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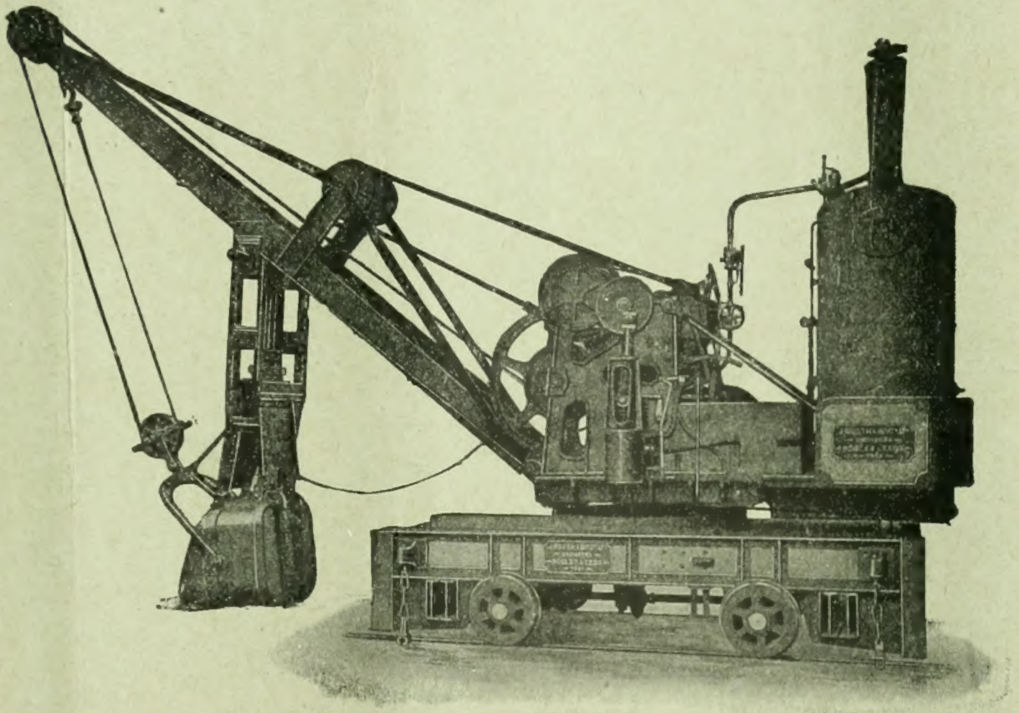

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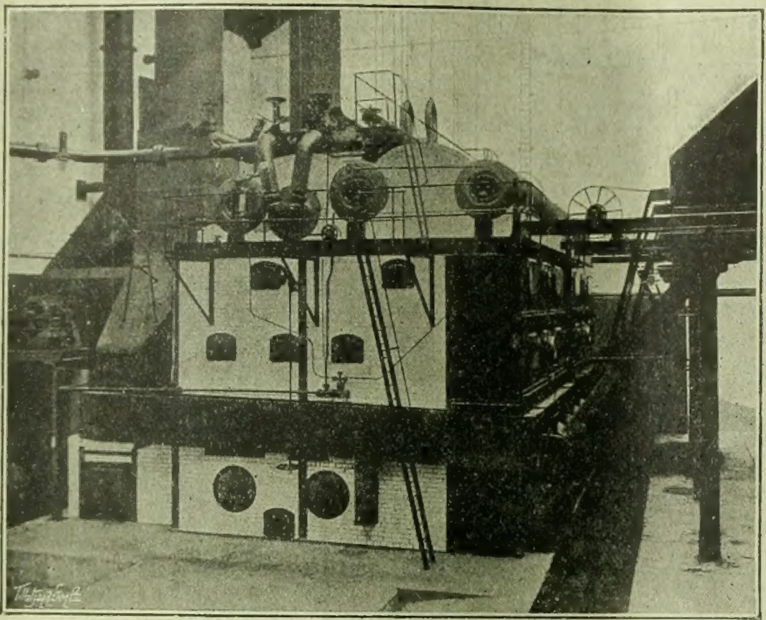

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